THE EARTH AND THE WORD.

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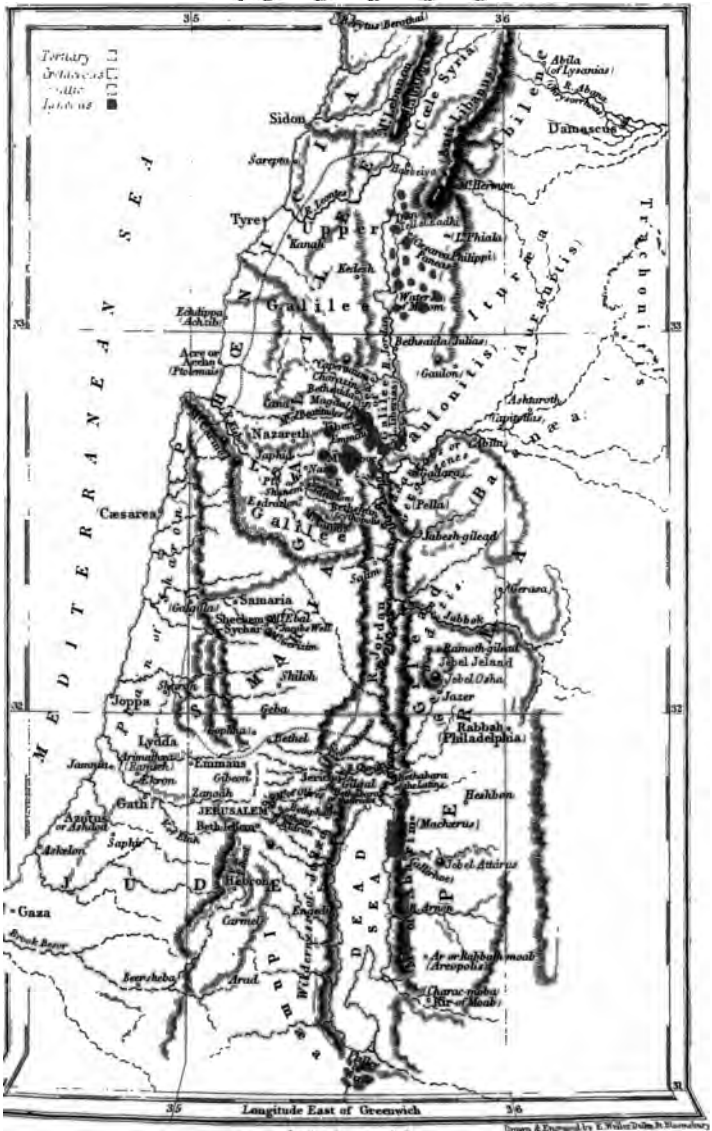

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THE EARTH AND THE WORD

OR

GEOLOGY FOR BIBLE STUDENTS.

BY

S. R. PATTISON, F.G.S.

"For now he is no philosopher who will not attempt to make a new philosophical world and produce his module thereof."

DE GOTTE *on Genesis*, 1670.

LONDON:
LONGMAN, BROWN, GREEN, LONGMANS, & ROBERTS.
1858.

PREFACE.

THIS is not another attempt to construct a scheme of reconciliation which shall satisfy all parties, nor a new theory of interpretation either of the earth or the Word of God; but an endeavour to consider both records together with equal reverence as being of equal authority.

Undoubtedly the minds of many good men are uneasy at the suspicion of a conflict between the testimonies, just as on the eve of an important trial the young advocate is distressed by the prospect of contrary evidence equally credible. But in both cases the open examination removes, one by one, all the apparent discrepancies, and truth comes out all the more illustrious for the clouds which beset its course.

I have not adverted (except in the bibliographical chapter) to many of the exceedingly able books which have been written on this subject.

It were an ungracious task to refute the geological errors of the one party, or to rebuke the theological indifference of the other. The best remedy —as in all analogous cases—is the simple exhibition of the truth, both physical and moral. This has been my aim.

> "The head and front of my offending
> Hath this extent, no more."

It is difficult, and would be undesirable, to do this without kindling into some measure of enthusiasm as the proofs of the Divine Goodness accumulate on the march. We do not trace the biography of a benefactor with the same coldness as the history of a tyrant.

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THE EARTH AND THE WORD,

&c.

CHAPTER I.

THE BEGINNING.—COSMOGONY.

"In the beginning God created the heavens and the earth."

FROM some eminence, ascended in the course of our autumnal ramble, we see the green earth spread out before us as a map. Its aspect, colour, composition, and arrangement suggest design; we ask, was it made for us?—by whom?—and when? Memory brings to our recollection the offerings made by "mother earth" to our material well-being, and we readily conclude, that the requirements of man had something to do with its origin and plan.

The shrewdest observers and most profound

thinkers in all ages, who have investigated the condition of the earth, have arrived at the universal conclusion, that "The hand that made it is divine." From deepest mines and loftiest mountains, from primeval rocks and alluvial plains, from liquid ocean and ambient air, the testimony springs up "In the beginning *God* made the heavens and the earth."

And, indeed, during the last half-century, the wits of philosophers were greatly exercised on the demonstrations of the attributes of God to be discovered in the existing state of things. The kind and amount of proof of which the subject is capable, still occasion honourable and useful mental labour. We can, however, afford to be independent of all such attempts in regard to the foundation fact itself, for we derive it from the primal divine announcement to man, in the book which is the only record of "The true sayings of God." In all languages God is owned as creator. The various schools of Grecian philosophy adopted rival theories concerning the mode in which things subsisted, but on the divine origin of the things themselves all were agreed. The wearisome efforts of the ancient metaphysicians to invent a consistent hypothesis concerning the method and order of creation, a task so superhuman and so useless, is very affecting as an exhibition of the want of true wisdom. It evinces our proneness

to neglect the useful and hopeful for the vain prosecution of the useless and hopeless.

Nor is the argument arising from a cosmical survey of the whole creation weakened, if we confine our view to any of the great divisions into which science separates the visible universe; nor if we further separate any of the orderly subdivisions from the still vast and various group of general phenomena. Taking geology, the science of the earth, as an illustration, we have only to open its literature to find that it abounds in lofty demonstrations of the power, wisdom, and goodness of God, which have embarrassed only by their opulence all who have written on the subject.

So if we descend to the consideration of a single class of strata connected by some common similarity, such as the oolite or the carboniferous, the same great argument presses us on every side, rendering it quite easy to write as many treatises of natural theology as there are layers of substance in the earth, and that without the least infringement on their mutual independence of each other. A few brief references to ordinary knowledge will serve to show this. We have —

1. The present surface with its varied composition, adapted for vegetable productions requiring corresponding differences of soil, water, and drainage.

2. The remains of former successive land sur-

faces constituting the inexhaustible virgin forest soils of the world.

3. The remains of former surfaces, when animal life somewhat differed from the present. The drift period, which has so usefully mixed and enriched the soils of a large portion of the world.

4. The tertiary beds, presenting us in and around London with gravel for roads, brick earth for our buildings; elsewhere with clays and sands for pottery, earths for cement; in the Isle of Wight and around Paris, stone for stately houses; in Suffolk with phosphates for manure. The lower sands serve as a storehouse for the water falling on the whole area, which sinks through this great natural filter, and gushes forth along its edges to supply the population above. Most of the capital cities of western Europe stand on tertiary formations, and thus prove the adaptation of their contents to the complex necessities of a high civilisation.

5. The chalk furnishes an unlimited supply of carbonate of lime, a substance absolutely indispensable to man in his social condition on the earth. The sands at the base of the chalk also serve as vast water-bearing strata, to purify and carry up living streams.

6. The oolite deposits, whether occurring in the sunny knolls of Somersetshire, the cliffs of Portland, the flanks of the Jura mountains, or in the

crests of Lebanon, display a vast series of useful rocks, exactly adapted for building the structures which individual and public life require. Amidst the verdant vales of Gloucestershire listen to the sound of the stone-cutter on the hill side, and admire the great amount of industry called forth by a production so common as freestone.

7. The new red sandstone reminds us of marvellous treasures, in deep lakes of brine, or mines of salt, which for ages have been yielding their indispensable supplies to the universal wants of man.

8. The coal measures may be traced, not by the greenness of their vegetation, nor the beauty their cornfields, but by the hum of a teeming population employed in extracting and using the boundless stores of the mineral fuel, iron, and limestone, which render this one group of rocks, an abounding and abiding demonstration of the goodness of God.

9. The old slaty rocks, the Devonian, Silurian, and Cambrian, glitter with mineral wealth. Our roofs are covered with the leaves of rock, thin and durable as metal; our trades are supplied with the produce of the mineral veins cleft in these ancient masses.

10. The crystalline and metamorphosed rocks bear for us the wear and tear of the world's traffic in our streets, and form monuments which seem

to connect ages together. The obvious effects of these crystalline rocks in the development and concentration of the diffused mineral wealth of the slate beds amongst which they have been intruded, are notable proofs of their value.

As we have thus rapidly travelled downwards through the series of strata which underlie each other, we have omitted all mention of two branches of our inquiry: the first relating to the intimate forms of things, from which it could be shown that the very particles of the rocks do testify to a creator; the second relating to the proofs of Deity manifested by the remains of former life-bearing structures, called organic fossils, which are to be found in all the rocks we have mentioned save those of the last group.

The science of these old forms, or Palæontology, is altogether a modern region, obtained by the skill and patience of recent investigators from the great ocean of the unknown. No sooner did it become *terra firma* than the Epicurean came to inquire whether it would testify to the existence of an *unknown* God; the Stoic to find whether its departing mists would conceal the present deity; but the Christian philosopher, with firm step and thankful heart, has taken possession of the country in the name of Him of whom all its productions testify; never again can it become debatable land. Men of scientific distinction in various

countries have vied with each other in stating the great argument for God founded on the structure of organised fossils; so that in the vast orchestra of a jubilant universe "dungeons and all deeps" do join the chorus and show forth his praise.

Sometimes when alone in the abandoned quarry, remote from the haunts of men, the stone, yielding to repeated blows, discloses some rare form of antique life, with traces of pearly lustre still owning and reflecting the sunlight; the devout geologist is overcome by the thought of the ages which have elapsed since it was seen by any eye save that of the Omniscient. Perhaps, in the pride of its lifetime, some angel mind glowed into admiration at its opening beauties, ere the curtain fell which has concealed it for ages. It has a history, and its disentombment shall be like the recovery of Pompeian viols; again it shall contribute to the praises of the universe as it powerfully pronounces the world-deep truth that "in the beginning" God was its Creator.

> "A loud hosanna sent from all thy works,
> Which he that hears it with a shout repeats,
> And adds his rapture to the general praise."

CHAP. II.

THE ARRANGEMENT.

"Consider the wondrous works of God. Dost thou know when God disposed them?"—Job xxxvii. 15.

A PERSON unacquainted with the scripture history of mankind would not have expected to find the arrangement of the earth's mineral masses such as it actually is.

It is not the best possible in the abstract, but the best possible in the present moral condition of the human family. A conclave of sages constructing an Utopian globe for an Utopian people, would have allotted to every portion a quantity of mineral riches adequate for its requirements, placed so as to be available for its use. Every man would have found himself within easy reach of all that he needed.

But the all-wise God, having regard to the moral ruin of man's nature, in devising methods for its recovery, ordered a state of things the very opposite to all this.

All rocks are either—1. Eruptive, thrown out

from the interior of the earth in a tenacious state; 2. Sedimentary, deposited from fluid; 3. Conglomerate, made up of the torn fragments of other rocks; or 4. Metamorphic, that is, altered by the vicinity of eruptive rock.

All these are to some extent formed under our observation at present. We see volcanoes adding lavas or pumice to the mountains whence they issue; mud banks becoming gradually consolidated; fragments of the winter floods becoming cemented into stone; loose sand or clay in the neighbourhood of lava-streams becoming hard rock. But our modern instances are feeble exhibitions compared with those of the ancient world.

The mineral constituents are irregularly and unequally distributed; the metallic treasures hidden deep in the clefts of the solid rocks, attainable only in limited quantities, by much labour and skill. The result of this arrangement is to bring man everywhere, as a condition of his well-being, under a necessity to exercise intelligence, industry, art, and perseverance.

The general disposition is in beds or layers, interrupted by unconformable masses, by which the beds have been broken through and raised up subsequently to their deposition.

The lines of any of our English railways will serve to show this. On the Great Western, for

instance, we shall find a change of strata nearly at every station, thus: —

Paddington - - -	Superficial gravels.
West Drayton - -	London clay.
Reading - - -	Plastic sands.
Pangbourne - - -	Upper chalk.
Goring - - -	Middle chalk.
Wallingford road - -	Lower chalk.
Didcot - - -	Upper greensand.
Farringdon road - -	Lower greensand.
Steventon - - -	Gault clay.
Shrivenham - - -	Portland oolite.
Swindon - - -	Kimmeridge oolite.
Wootton Basset - -	Coral oolite.
Chippenham - - -	Cornbrash oolite.
Corsham - - -	Middle oolite.
Box Tunnel - - -	Great oolite.
Box - - - -	Lower oolite.
Bath - - - -	Upper lias.
Keynsham - - -	Lower lias.
Bristol - - -	New red sandstone.
Nailsea - - -	Coal.
Taunton - - -	New red sandstone (again).
Wellington - - -	Devonian rocks.
Exeter - - -	New red sandstone (again).
Newton Abbot - -	Mountain limestone.
Totness - - -	Devonian rocks (again).
Plymouth - - -	Upper Devonian.
Liskeard - - -	Lower Devonian.
St. Austell - - -	Granite.

The changes would be found still more numerous if noted minutely along the line.

Leaving out the repetitions, the whole of this is a descending series; that is, every successive formation, in our downward journey towards the Land's

End, crops out from beneath the preceding one. This has no connexion with the absolute height of the hills; for we shall find the granite and slate much more mountainous than the uppermost gravels at Hampstead. Nor is it a singular instance; for, wherever elsewhere we discover any two of the formations which we encountered in our Western journey, we shall find them occupying the same relative position to each other. We shall not find all the terms of the series in every place, but wherever we do find them, the order of succession is the same.

If we add to this the consideration of the easily observed fact, that each of these layers is characterised by a different set of monuments of former life, a different collection of organic remains, we shall be prepared to accept the statements of careful observers who have carried on over the world at large a similar course of investigation to that which we have pursued on the railway.

The result of extensive and careful observation has shown that the following succession of strata obtains as a general rule, and prevails, without exception, in respect of *order*, over the globe, whether the members of the succession at any given place may be many or few.

I. POST-TERTIARY.

RECENT. — Peat and alluvium with human remains and works of art. Deposits with fossil shells of recent species, but without any human remains or works.

II. TERTIARY.

1. PLIOCENE.

Newer Pliocene: —

Drift, gravel, and boulder clay; Norwich Crag and cavern remains, with elephant bones and shells, nearly all recent, divisible into three or four distinct periods.

Older Pliocene: —

Marine coralline crag of Suffolk.

2. MIOCENE.

Upper Miocene: —

Touraine strata, land and sea.

Lower Miocene: —

Hempstead beds in the Isle of Wight.

3. EOCENE.

Upper Eocene: —

Bembridge and other freshwater limestones in the Isle of Wight, and at Montmartre.

Middle Eocene: —

Bagshot sand. Calcaire grossière.
Nummulitic strata.

Lower Eocene: —

London clay.
Woolwich sands.
Thanet sands.

III. SECONDARY.

CRETACEOUS.

1. Maestricht chalk.
2. Upper white chalk with flints.

3. Lower chalk without flints.
4. Upper greensand. Firestone.
5. Gault clay. Whetstones.
6. Coloured sands and rough stone.
7. Weald clay.
8. Hastings sand.

OOLITES.

9. Purbeck stone
10. Portland stone } Upper Oolite.
11. Kimmeridge clay
12. Coral rag } Middle Oolite.
13. Oxford clay
14. Bath stone
15. Fuller's earth } Lower Oolite.
16. Inferior oolite
17. Lias: —
    Upper lias.
    Marlstone.
    Lower lias.
18. Salt-bearing rocks of Cheshire
19. Muschelkalk of Germany } New red sandstone.
20. Lower sandstones

IV. PALÆOZOIC.

1. MAGNESIAN LIMESTONE.

2. COAL MEASURES.

   Upper Coal: —
   Millstone grit.

   Lower Coal: —
   Mountain limestone.
   Carboniferous slate.

3. DEVONIAN.

   Upper Devonian: —
   Plymouth.

   Lower Devonian: —
   North Devon and Caithness.

4. SILURIAN.

Upper Silurian:—
Ludlow.
Wenlock.
Caradoc.

Lower Silurian:
Llandeilo and Bala.

5. CAMBRIAN.

Lingula flags.
Primordial zone.

Reference to Sir Charles Lyell's recent edition of his valuable Manual * will show that upwards of 130 formations of rock, clay, or sand, have been well ascertained; each having a constant position in relation to every other, each characterised by a distinct collection of fossil organic remains.

Nor does the wonder end here, for if we examine any of the formations dismissed in a single line in our table, we shall find that each contains proofs of succession within itself, disclosing a history of its own, on which a volume might be written.

The report of the government surveyors on the Isle of Wight, shows that the same kind of evidence which enables us to separate the London clay from the chalk, also proves that in one formation, the upper eocene, at White Cliff Bay, there are 55 distinct layers or beds, which must have been all deposited horizontally, each forming

* Supplement, 5th edit., 1857.

for some time a sea floor or land surface, all raised and lowered from the water level at least as many times, and ultimately raised in curves forming the present shore.

Any memoir on a single formation, any full descriptive geology of a limited district, will serve to show the same fact. So vast and various are the phenomena, that every successive stratum has now a literature of its own, its own peculiar natural history, its flora, its fauna, its topography and physical geography.

To these considerations we must add that of the crystalline and volcanic rocks—granite and its associates, basalt and lava. Upwards of 40 distinct varieties of these are known. The only order of succession that can be established is derived from observing the surface over which they flowed: whether they have ravaged and rifted the present green earth in the shape of modern lava flows; or, as in Central France, have mingled with the early tertiaries; or, as in Greece, with the cretaceous beds; or, as in South Devon, with the new red sandstones; or, as in Fifeshire, with the coal; or, in Cornwall, with the Devonians; or, in Wales, with the Cambrians.

The older bursts and flows of molten matter were principally granite and greenstone. Their modern successors are lava and pumice. Beds of volcanic ash are common to both periods. The

exhibition of these effects before the close of the tertiary period is incomparably more extensive than since.

The influence of these crystalline rocks on the sedimentary beds has been so strange and powerful, that it was long ere even scientific observers were bold enough to give the real interpretation.

In the Alps, for instance, we may trace the limestone and marls of the secondary rocks from their position in advance of the mountains, with all their usual characteristic fossils, until we find them in contact with the granite axis of the chain. They then become actually converted into solid masses of semi-crystalline rocks. Fossils gradually harden, and their outlines disappear under the influences of the severe physical forces brought into play. The shale, clays, and limestones become metamorphosed, the very substances which at one end of our explorations lie as they were left by primeval waters, become at the other end strong mountain masses of mica slate and adamantine rock. Such is the history of some of the most beautiful statuary marbles; the Parian and Carrara are merely hardened chalk marls. We thus discover that the chemical laws of affinity, like the organic laws of life, have been the same from the first; we are led into another vast field of preparation for the present, far back in the vista of the past.

We are now treating of the mere juxtaposition of these mineral masses, affirming that they are placed in the best possible manner for the development and exercise of man's powers in obtaining the supply of his wants.

In order to obtain superiority in manufacture, it is necessary that the raw material should superabound in some locality, so as to render it there an object of attention in preference to other things. This is just the method manifested in the allotment of minerals on the earth.

There are slender beds of coal in the Devonian, considerable accumulations in some parts of the oolites, much of lignite among the tertiaries, but the main bulk of the coal deposits throughout the world occur in one group alone, always occupying the same relative position, and emphatically called the coal measures. This determines the industrial operations of a district, provides for the division of labour on a grand scale, and, by the special education of some, promotes the social welfare of the whole.

In like manner is it with the metals. Indications of these are scattered through all strata, especially the more ancient, and those which have been most disturbed by igneous rocks; but they exist in sufficient quantities for commercial purposes only in the older slate rocks, and near

or in granite, with the exception of iron, which, like the cereal plants, being of more general use, is also of the widest range.

So the salt impregnating the brine springs of Cheshire would be lost if diffused amongst the mass of strata above and below it; but, by being stored between the layers of the trias, in beds of 90 feet thick, it furnishes a supply in the mode best adapted to call forth the art and industry of man.

The present actual arrangement has not been effected by the continuance of tranquil processes alone. The earth shows traces, in its rocky records, of many periods during which its surface was the theatre of physical disturbance and revolution of the mightiest character.

Notwithstanding all the ability displayed by writers seeking to show that all visible effects may have been produced by causes now in operation, working at their present average intensity, it must be acknowledged that the phenomena of the past do vastly outweigh the powers of the present. We must conclude, from the inclined and contorted strata, the broken and upturned mountain chains, the sweeping drift currents, the displacement of extensive areas, the shattering and reconstruction of enormous rock masses, and other similar events, quite ordinary in the early history of the world,—that in pre-historic times the display of physical

forces was inconceivably vast, various, and intense.

We are now well able to judge of this, for not only has the enterprise of man explored the surface of the earth and made its phenomena familiar to us, but the depths of the sea have been plumbed, and its hidden things brought to light. The soundings made for the Atlantic Telegraph show depressions deeper than the Himalayas, a channel of a mile and a half deep, a thousand miles long, scooped out by the Gulf Stream, the slow accumulation of delicate life-forms in the tranquil depths of ocean, and many effects which remind us of the rocks above. But the vastness of the forces acting on the latter still remains an unparalleled fact; and we therefore conclude, that though the laws of force were ever the same, the agencies were more active and potent.

In reviewing the arrangement, we are struck with the one property which belongs to all the varieties of material, namely, utility to man. As civilisation advances, one and another instance of this is discovered, and brought into practical demand in the common life of the world's population. We daily avail ourselves, in a thousand ways, of the vast stores of mineral matter laid up and prepared for this end amidst the slow processes of anterior time.

The earth is physically an inexhaustible treasury

of things new and old; morally, it is a temple, wherein the worshippers of every successive age are never without new materials for perpetual incense.

"And surely as time advances, and new and more profound adaptations of nature rise to view, as man comes to find that his race has been living for ages in the midst of complicated adaptations of which they were unconscious, and which could be developed only as the result of a long series of prior discoveries, but all tending to his well being, his recognition of the Creative wisdom and greatness will become more vivid and grateful, and the earth become more sacred in his eyes."* When we step across the threshold of a villa buried for ages under the ashes of Vesuvius, we are amidst the well-known relics of ordinary human life; so, on entering the caverns of the earth, we find them filled with the furniture of their former inhabitants. In the one case we trace with admiration the handiwork of the old Roman artist; in the other, the finger of God is manifest in the infinite skill and benevolence exhibited in these buried organisations. But if amidst the ruins of the former we should discover some work executed with the lofty purpose of benefiting distant posterity, then gratitude would augment our admiration at the display of so much goodness and skill. Such a claim has geology

* Harris's Pre-Adamite Earth, p. 338.

on our regard, for it tells us, in language that cannot be otherwise interpreted, of the Divine care and provision exhibited for man long before he arrived to take possession.

And may not the devout Christian herein find some instructive analogy, on the floor of this lower earth, to the still greater process of preparation now in progress for a higher life beyond, as he thinks on our Saviour's promise?—"In my Father's house are many mansions. I go to prepare a place for you."*

* St. John xiv. 2.

CHAP. III.

THE CONTINUANCE.—PALÆONTOLOGY.

"Upholding all things by the word of his power."—Heb. i. 3.

THE Bible everywhere assumes not only the fact that God is the creator of the universe, but also that he gives it his continual presence and potency in all its processes and places. When the prophet Amos is denouncing divine judgments against the wicked, he declares the absolute certainty of their execution (in spite of superhuman efforts for escape), grounded on the omnipresence and active omnipotence of God. "Though they dig into hell, thence shall mine hand take them; though they climb up to heaven, thence will I bring them down: and though they hide themselves in the top of Carmel, I will search and take them out thence; and though they be hid from my sight in the bottom of the sea, thence will I command the serpent, and he shall bite them: and though they go into captivity before their enemies, thence will I command the sword, and it shall slay them: and I will set mine eyes upon them for evil and not

for good. And the Lord God of hosts is he that toucheth the land, and it shall melt, and all that dwelleth therein shall mourn; and it shall rise up wholly like a flood, and shall be drowned as by the flood of Egypt. It is he that buildeth his stories in the heavens, and hath founded his troop in the earth; he hath called for the waters of the sea, and poured them out upon the face of the earth; the Lord is his name."*

The figures imply the incessant present agency of God, as well as his absolute supremacy.

The mineral world bears the same testimony. The old hills have, from the beginning, been subjected to processes varying in direction and intensity; all substances, including the densest and toughest, have been made plastic for the construction of the present temple of creation.

The realms of past life show forth the same truth, in the numberless provisions made for sustenance during the ages long ago, as well as the various modes of supply; all with differing operations bending to the accomplishment of the one great end. The notion of an intelligent *first* cause only will not solve the phenomena; to do this requires the idea of a continual active causation, raising in our minds the conviction of a God who "everywhere hath sway," and by whom "are all things."

* Amos ix. 2—6.

In a large sense, the present state of things is a period of repose. We see no new continents emerging under our eyes, no new phase of organic life arising before our vision. But, on inspection, we find that this general repose of the whole covers incessant action in every part. No river bed is stable, no sea-margin the same for two days together; every valley, every delta, every rock, every mountain, undergoes some amount of daily displacement and change. In some parts of the world, volcanic forces still effect obvious changes in the contour of the surface. So also in organic life, we have the same plants and animals that were known to our forefathers; the pictured mummy-cases of Egypt, the sculptures of Nineveh, the writings of ancient men, all prove that external nature, as a whole, has remained the same during the entire historical period; but this has been accompanied by frequent local changes in the proportion of species at all places.

These variations are all within limits not definable, but practically consistent with the general stability of the whole, from age to age. No historical instance is known to us of a whole nation losing its country by geological convulsion. The phenomena of mutation, though occasionally scaring the world into thoughtfulness, do not practically set at nought the business either of national or individual life. "All things continue as they were;" the great transforming energies are un-

der still greater moral control. Since the commencement of the historical era, we learn alike from sacred and profane history and from geology, that the apparently disturbing events have been few and far between; whilst we are taught by the pre-historic ages, that periods of tranquil life-progress were then often succeeded by intermissions of turbulent action and volcanic energy. We will for the present assume that organic remains do stamp the age and relative position of the rock masses, independently of their mineral constitution or geographical position. This leading fact, on which so much of science is now based, will sufficiently become apparent in the course of our investigations. "The fossiliferous strata present us with the entombed floras and faunas of bygone millenniums. We ascend in time, whilst, penetrating downwards from layer to layer, we determine the relations in space of the several formations. An animal and vegetable existence that has passed away is brought to light; wide-spread revolutions of the globe, the upheaval of mighty mountain chains, whose relative ages we are in a condition to determine, denote the destruction of old organic forms—the appearance of new. A few of the older still show themselves for a time among the newer forms."* A rapid view of these realms will best unfold the fact of the Creator's

* Humboldt's Kosmos, vol. i. p. 288.

presence all through the ages. There lies buried within the rocks the counterpart of the beautiful life now adorning the surface; not identical in form, but quite identical in the testimony which it yields to its Maker.

In the British islands alone, according to the careful elaborate catalogue of Professor Morris,* there were discovered, up to 1854, the following number of species of organic fossils:

	No of Species.	Of which marked recent.
Plants - - - -	613	0
Diatomaceæ - - -	68	1
Amorphozoa - - -	142	0
Foraminifera - - -	225	34
Zoophyta - - -	456	0
Echinodermata - - -	497	1
Annelida - - -	134	3
Cirrhipedia - - -	44	9
Crustacea - - -	303	9
Insecta - - - -	68	0
Bryozoa - - -	265	6
Brachiopoda - - -	663	2
Rudistes - - -	1	0
Monomyaria - - -	592	11
Dimyaria - - -	1300	40
Pteropoda - - -	13	0
Gasteropoda - - -	1577	0
Cephalopoda - - -	684	0
Pisces - - - -	749	0
Reptilia - - -	181	0
Aves - - - -	11	0
Mammalia† - - -	97	0

* A Catalogue of British Fossils, 2nd edit., 1854.

† We have added from the discoveries of Mr. Beckles in the Purbeck beds; vide Geol. Journ., 1857.

There are 15,055 species of organic fossils now actually classified in the Museum at Jermyn Street. Let these statements be pondered well before proceeding farther; there have been found within the area of these islands upwards of fifteen thousand species of once living things, every one differing specifically from those of the present creation.

Agassiz states that, with the exception of one small fossil fish, discovered in the claystones of Greenland, he has not found any creature of this class, in all the geological strata, identical with any fish now living.

Let it also be borne in mind, that we are not now speaking of individuals, but of races. We have coral reefs, with gemmules springing from the parent zoophyte; shells, with myriads in all stages of growth around them; crustaceans, with shoals of young; elephants, with milk teeth only; and plants of all growths. Other parts of the world are equally rich with our own much explored country. Large volumes are filled with the Palæontology of France, of Germany, of Bohemia, of India, of the separate states of North America, and other countries. The zoology and botany of one country differs from that of another, and although there is considerable uniformity in marine life, and many species have a remarkably wide geographical range in the same

formation, yet it is now established that, during all periods of the past, the earth has been adorned with variety as well as with beauty; and that every platform of land has had its distinct botanical and zoological provinces.

Inasmuch as the lowest strata were most assuredly deposited first, and as the lowest are those which would be so were the inclined strata again brought into a horizontal position, the distribution of these fossils constitutes the main interest of geological science, considered as one of history. In our proposed visit to the catacombs of the old world we will explore from the surface downwards, pausing only at the well-marked stages of descent.

I. Post-Tertiary.

1. *Recent.*—The layer of material now in course of formation is emphatically the dust of the earth. It has the unique distinction of being the burial-place of man, and is to be the theatre of the miracle of the resurrection. The fossils associated with the works of man only vary from their living successors to the same extent as is now shown by the distribution of life in any one locality in successive years. The annual visitor to the coast will recollect that the small sandy bay of one season becomes the pebble beach of another; the

attractive strand where, as children say, there is "good shelling," is frequently found to have changed its locality altogether. The shifting of the shell sand, or sea weed, on the coast, frequently affects the annual value of the adjacent cliff farms. For a series of years manure is freely thrown up by every tide; another term may run on and the farmer have to send many miles for the same substances, owing to the shifting of the currents, probably in consequence of an alteration in the contour of the ocean bed. The variations caused by man, in the zoology and botany of the district wherein he acts and become civilized, are well known to every sportsman and antiquarian. A good example of these changes is frequently afforded by drainage works. On partially draining, in 1856, a small lake near Morsedorf (Canton of Berne), an area of about seventy feet in length and fifty feet broad, along the bank of the lower extremity of this lake, was found to be paved more or less closely with posts of oak, aspen, birch, and elm, driven through two beds of peat, three or four feet thick, of exclusively vegetable origin in its upper part, including many relics of human industry and art in its lower portion. Dr. Uhlmann collected nearly a thousand specimens, viz., fragments of pottery, stone chisels, stone arrow-heads, pieces of cat bones, and perforated bear teeth, without any trace of metallic objects. The lower

end of the posts have evidently been also worked into their pointed shape by the means of stone tools. The upper portion of the bed containing these remains exhibited traces of combustion, and contained carbonized grains of barley. Together with the above-mentioned works of art were found many fragments of bones, both of domesticated and wild animals, viz., horned, horses, swine, dogs of various sizes, goats, sheep, cats, elks, stags, aurochs, bears, wild boars, foxes, beavers, tortoises, several birds, and other animals.*

II. Tertiary.

1. *Pliocene. Newer Pliocene.*—Immediately that we leave the accumulations wherein are buried monuments of man, and step downward into prehistoric times, we find two facts at the threshold of our investigations. First, that the same creatures did not live in the same places then as now; secondly, that we have lost many modern species, and have found many others entirely unknown at the present. These conclusions are correct as well in regard to sea as land—to vegetables as to animals.

On removing the vegetable soil, there will become apparent local accumulations of gravel, of brick-earth, or of mud. On entering a cavern,

* Proceedings of Imperial Institute of Vienna, June, 1857.

there will be found a consolidated mass of fragments of former life. These depositaries abound in remains of large mammalia, especially of proboscidean creatures, far outnumbering and overmatching their successors of the present day. South America has its charnel plains of megatherium bones, North America of mastodons, India of elephants, England of bears, elephants, and buffaloes. The groups of these animals, which occupied the land during the latter prehistoric period, were more varied and numerous in large pachydermata than the present creation. The number and variety of the mammals of England, for instance, is as though large districts in the eastern counties had been for ages a zoological garden. The bear and hyena owned the dens, the rhinoceros and elephant the plains. Large folios have been published, descriptive of the marvels of zoology at this date. Our local museums contain innumerable fragments of the former tenants of our land; the county histories record them; ancient romances show them to have been the ground-work of much superstition and amusing error.

Notwithstanding the labours of many geologists in the fields of the newer deposits, it may still be truly said, "that of all geological periods, that which comes nearest our own times is the least

understood."* Hugh Miller conveys a vivid image of the border land in his latest (and alas! his last) work.

"We can trace several of our existing quadrupeds, such as the badger, the hare, the fox, the red deer, and the wild cat, up till the earlier times of the Pleistocene; and not a few of our existing shells, such as the great pecten, the edible oyster, the whelk, and the pelican's foot shell, up till the greatly earlier times of the Coralline Crag.

"But at certain definite lines in the deposits of the past, representative of certain points in the course of time, the existing mammals and molluscs, even such of our British shells as seem to have enjoyed, as species, the longest term of life, cannot be traced beyond the times of the Pliocene deposits. We detect their remains in a perfect state of keeping in almost every shell-bearing bed, till we reach the Red and Coralline Crags, where we find them for the last time; and on passing into older and deeper lying beds, we see their places taken by other shells, of species altogether distinct. The very common shell, *Purpura lapillus*, for instance, is found in our raised beaches, in our Clyde beds, in our boulder clays and mammaliferous crags, and finally in the Red Crag, beyond which it fails to appear.

* Mr. Godwin Austen, Geol. Journ., vol. xiii. p. 69.

"And such, also, is the history of the common edible mussel and common periwinkle; whereas the common edible cockle, and common edible pecten (*P. opercularis*), occur not only in the successive beds, but in the coral crag also.

"They are older by a whole deposit than their present contemporaries the periwinkle and mussel; and these, in turn, seem of older standing than shells such as *Murex erinaceus*, that has not been traced beyond the times of the mammaliferous crag, or than shells such as *Scrobicularia piperata*, that has not been detected in more ancient deposits than raised sea-beaches of the later periods, and the elevated bottoms of old estuaries and lagoons. We thus know that, in certain periods nearer or more remote, all our existing molluscs began to exist, and that they had no existence during the previous periods." *

There are 442 species of shells found in the English crag deposits, of which, from the uppermost crag, 69 are recent and 12 extinct; from the middle, or red crag, 130 are recent, and 95 extinct; from the lower crag, 168 are recent, and 159 extinct. Of the recent species in the upper crag, 12 species now inhabit the arctic seas, and do not range to our present shores; and in the

* Lyell's Supplement, p. 4.

lower crag, 27 species now dwell in southern seas, and do not approach our modern shores.*

The proofs are overwhelming of the prevalence, at the early Pliocene period, of a warmer temperature than the present, which became gradually cooler, until it became colder than at present, and ended in arctic rigour, attaining its maximum of cold during the glacial period of the boulder clay, which contains shells of recent species now living in arctic seas.

Miocene.—A deposit of shell-sand is found on the Loire, and other places in France, which contains a vast number of beautiful marine forms, of which only about 25 per cent. are recent, and only about 15 per cent. found in the lower crag. The remains of lamantine, morse, sea-calf, and dolphin, with shells and corals, indicate a higher temperature than the crag; as do the terrestrial remains, consisting of deinotherium, mastodon, rhinoceros, hippopotamus, cheiropotamus, dichobune, and deer, all of extinct species. In deposits of the same age in India, are found a wondrous assemblage of mammalian remains, fine specimens of which may be seen in the British Museum; deinotheria, mastodons, several species of elephants, sivatherium, giraffe, camel, antelopes, monkeys, crocodiles, all of gigantic dimensions.

* Testimony of the Rocks, p. 195.

Switzerland displays the beds of some ancient fresh-water lakes, containing the bones of no less than 28 distinct species of turtle, most of them having a local range, distributed, in different proportions, in the marl deposits of the molasse of that country.

Eocene. — We enter not on a formation, but on a world when we come to the eocene, the dawn of the other world which exists around us. It has its oceans, whose sediment imbedded the nautilus with hundreds of delicate shells occupying all their depths; its estuaries, whose ancient silt we now turn into pottery; its vast rivers, with long lines of fresh-water shells; its low hills and islands, covered with vegetation like that of the eastern archipelago; its pebble banks and sand beaches; nay, its succession of all these, with life appropriate to each. Around its lakes we find remains of a numerous but peculiar fauna, all now extinct.

In one locality, and in one bed alone of this formation, the gypsum building-stone beds at Montmartre, there have been found associated with palmettos the relics of about fifty species of quadrupeds. About four-fifths of these belong to a division of the pachydermatous creatures now represented by the tapirs and the daman of the Cape. There were a few carnivorous animals, ten kinds of birds, and other representative races.

The Eocene sands and building stones occur ex-

tensively around the great centres of European civilisation, and have been consequently very largely explored, and their contents ascertained. Collections of fossil shells from the Paris basin, from our own London clay, and from the Hampshire series, are not uncommon. To the eye of the conchologist these assemblages have a pale foreign look.

The ascertained group of life in the London tertiaries is —

Plants	106
Mammalia	6
Birds	4
Reptiles	23
Fishes	84
Molluscs	280
Articulated animals	33
Radiated animals	17
Zoophytes	10
Foraminifera	28 *

The most experienced and indefatigable labourer in the field, Mons. Deshayes, after thirty years' study, announces it as his mature opinion, that there is no single species common to these beds and also to the chalk. There is a positive and abrupt transition between the species of molluscous life in the two great formations, and an equally decided and total change between the floras of the two formations.

* Prestwich, Geol. Journ., vol. x.

The Middle Eocene is characterised, throughout a belt of land extending from Persia to Paris, and across the new world, as the period of the nummulites.

These foraminifera are minute marine chambered shells, found in such myriads as to constitute large masses of the prevalent rock in many districts.

There are between seven and eight hundred distinct species of these little creatures, none known before the chalk, the bulk in the Middle Eocene, and not a single species in any later formation, or in the recent world.

The impression produced by a view of life in the whole tertiary period undoubtedly is, that there was a gradual mutation from the lowest upwards, all tending to approximate to the present, and yet representative of it, and not identical. It is evident also, on a large comparison, that the migration of species was going on all through these periods. Physical changes were introductory of life changes, and portions of one fauna were preserved into another, and other portions wholly dropped.*

The Eocene deposits at Whitecliff Bay, in the Isle of Wight, afford, according to the late Professor E. Forbes, proofs of the following succession. First, there is a considerable thickness of mottled

* Prestwich, Geol. Journ., vol. xiii., p. 132.

clays resting on the chalk, then the fauna commences with numerous peculiar myatiform shells, pectuncula, ostrea, and others, in a series of sands and clays, the earliest fossiliferous bed consisting of a thin stratum of the shells of a pteropodous mollusc (*ditrupa plana*), which continued but a short time in life and then became totally extinct. In the midst of this group occur strata charged with myriads of nummulites; next, the sea-bed became covered with a fresh-water lake, as is denoted by a stratum of paludina clay, then returned to a brackish state, again a fresh-water lake, lastly a marine condition, enabling oysters to live for a short time. Similar and yet varied changes were contemporaneous in other Eocene localities.

M. De la Harpe, after a full examination of the plants of the Eocene flora, concludes "That there exists, from the lowest tertiary forms upwards, a gradual mutation in the vegetation, which tends to approximate it by slow degrees to the existing flora of our own climate, and yet that scarcely one species has passed the boundary of the Eocene to penetrate into the Miocene, and not one of the Miocene has been prolonged into the existing flora."*

Chalk.—The fossils of the chalk show, for the most part, a deep ocean with few shallows and islands. Sea-urchins, sponges, and corals abound

* President's Address, Geol. Journ., 1857.

in many places, with ammonites, belemnites, turrilites, baculites, and other representatives of extinct families of cephalopods. Remains of sharks and curious-looking fishes, with occasional bones of saurian creatures, occur in some spots, but in general, terebratula and small oysters indicate "the deep, deep sea." Ranging along a parallel far south of our own island, the lower chalk is distinguished by a limestone, bearing abundant traces of an extinct family of shell-fish, called Hippurites, each fashioned like certain conical drinking jugs of our forefathers, without handle or pedestal.

The lower chalk passes downwards into a grey rock with green grains and layers of sandstone. This is the firestone of the geologists; at other places it is substituted by chalk marl. In both these formations occur beautiful cephalopods of excessive rarity, or quite unknown in the white chalk above. These deposits are based upon another rich bed of organic remains, which, in the south-east of England, assumes the character of a blue clay, and is called the gault, in the west of England it is the scythe-stone layer of the Black Downs; on the continent it is largely developed as a peculiar sandstone. The fossils obtained from this deposit, either at Folkstone or Blackdown, attract attention by the preservation of their framework in ornamental repair, still glistening with mother-of-pearl

in the gault, or shining with silicified tubercles in the sands.

The lowest beds show ample traces of sea margin. The green sand is largely developed in the south-east of England. Its floated timber, occasional leaves, and varied shells, show a littoral deposit of enormous duration and extent.

The section of the lower green sand exposed in the cliffs on the south-west shore of the Isle of Wight, affords an excellent opportunity of investigating its fossil contents. Usually, in England, it is an uninteresting deposit, with a surface of poor land and sections of siliceous barren sands. In this locality, however, the beds are of more varied composition. They have been raised at a low angle, the coast line cuts them off diagonally; ruin has attacked them variously, owing to the different resistance of the materials. The leaves of the wonderful book thus opened have been carefully deciphered by Dr. Fitton, and measured by Captain Ibbetson.*

In the space of about two and a half miles there are fifty-five strata, which, if piled one on another, would make a thickness of 800 feet. These are divided into fifty-five layers of varying thickness, each characterised by different conditions of structure and contained life, so that we have here the basins of fifty-five successive seas.

* See Geol. Journ., vol. xii.

Oolite.—In the delta of the mighty rivers of the latest Oolite period, we find the bones of the great lizard of the weald,—the Iguanodon,—with ferns and pines. Dr. Mantell, the historian of this epoch, enumerates five genera of terrestial plants, several species of river shells, a small fresh-water crustacean, fishes allied to the bony pike and the shark, two or three genera of turtles, and seven or eight species of most marvellous terrestrial saurian reptiles; at least six well-marked coniferous trees, and numerous other plants. We have in the Isle of Wight, and on the south coast of England, the shallows at the mouth of a vast river flowing through tropical forests of peculiar vegetation, inhabited by gigantic creatures, elsewhere unknown before or since.

The Purbeck beds of the Upper Oolite are well developed in our own country, and, having been wrought for ages for building stone, were supposed to have yielded up all their fossils, in the shape of the abundant lake shells which characterise the Purbeck marble; but about twelve months ago Mr. Beckles astonished and delighted the Palæontologists by forwarding, weekly, remains of new animals discovered in a quarry formed, apparently, in the margin of an ancient lake in the Purbecks. So new and numerous were these, that the mammalian forms known to have existed before the tertiary were speedily doubled.

Below the Purbecks we find the Portland, bearing in its midst the cycadian grove whose imbedded remains, now brought to light by the quarryman, tell us of the subtropical plants once flourishing where the scanty furze can now barely exist.

Below this is the Coral Rag, with its rich marine fauna of shells and corals, forming, in fact, a reef like those so fatally abundant in Torres Straits. The beautiful urchins and crinoids of this formation must attract the attention of the most casual visitor to an oolite collection. Then come the fossils of the great Bath stone, showing a variable sea; the Stonesfield oolite, with its opossum races, the lower oolites, and a large development of vegetation, producing considerable deposits of coal. This is principally coniferous, and it appears that the fir tribe attained its comparative maximum in the oolite era.

The lowest of the oolite beds, the Lias, is well known as the magazine of remains which have excited the amazement of the vulgar and the still greater surprise of the savans, — the great saurian bones. The capabilities of language and the possibilities of art have alike been tasked, to do justice to the amphibian creatures of the liassic period, and, after all, the *style* of being is so foreign to anything we see around us that we feel ourselves to be in possession only of carica-

ture outlines of the wondrous creatures whose bony framework is so common in our museums.

The thinnest bed of fossil shells, be they of the least considerable amount in the catalogue of the present, yet are connected by their containing medium, their local condition and associations, with the arrangements of the universe. How is it that they correspond with their matrix, whether of clay or sand, limestone or mud? How is it that they match the vegetation disclosed in the ruins of the adjacent land surfaces? Palæontology is fertile in such questions, and not dimly is the answer lithographed in its ample pages. "In the beginning *God* made the heavens and the earth."

The *Trias*, or Upper New Red Sandstone, is the storehouse of a novel and beautiful flora, and its slabs bear impressions of gigantic frog-like creatures.

In the *Permian* we find a still further departure from the forms of the present, and about sixty species of fossil plants, with shells and fish of deep-sea kinds.

The *Coal Measures* speak to us of profuse vegetation, but, as is well known, of a type entirely dissimilar, as a whole, from that of the present day. The cases of our museums may be filled from one of our British collieries, or replenished from those of Europe, or America, or New Holland, but the results, as to genera, will

be altogether the same. Ferns will predominate in prodigious numbers and variety; club-mosses and equisetæ, in size and aspect greatly varying from the present; a few conebearers, no forest trees, no grasses, no fleshy fruits. The contrast between the past and the present becomes strikingly apparent in the flora of the coal. We are actually, at Kew and Chatsworth, trying, by the aid of combustion, which this ancient flora supports, to raise artificially a temperature sufficiently high to foster a few of their degenerate descendants on the very sites where they once flourished in congenial native freedom. Araucarianlike pine trees, fern forest-trees, with trunks displaying symmetrical and beautiful ornamentation, feathery ferns of 150 graceful forms, all then grew under the same skies where now the furze and heath, stunted and swept by the wintry blast, constitute the sole covering of the moorland.

The presence of insects, land-crabs, and large reptiles, in coal-bearing strata, is well ascertained, and completes the picture of the peculiar and yet complete condition of the carboniferous era, as a platform of vast preparation for the material benefit of man, whereon all was perfect, though subservient to an end then in the far future. "The flora of the Coal Measures was the richest and most luxuriant, in at least individual productions, with which the fossil botanist has formed

any acquaintance. Never before or since did our planet bear so rank a vegetation as that of which the numerous coal-seams and inflammable shale of the carboniferous period form but a portion of the remains; the portion spared in the first instance by dissipation and decay, and in the second by the denuding agencies. Almost all our coal—the stored-up fuel of a world—forms but a comparatively small part of the produce of this wonderful flora.*

The coal of each stratum displays its own association of plants, and so, on a wider scale, the coal of different formations exhibits characteristic vegetation. Thus the vascular vegetables prevail in the lower coal, ferns and cone-bearers in the upper, cycadians in the oolite, and forest trees in the tertiary.

The coal formation of Saxony has been well investigated by Geinitz. It displays five zones of successive vegetable life. There are 156 species of plants. The first zone has only one species out of twenty-three common to it and the second and third; between the second and third there are thirty-three species common; between the third and fourth, twenty-four; the third and fifth, thirty-three; the fourth and fifth, thirty-five.

Only three plants pass upwards into the Permian, so that the coal deposits are as decidedly

* Testimony of the Rocks, p. 26.

different from the beds above as they are from the strata below.

We commonly find a coarse clay, into which run the roots of trees, and occasionally mud with fresh-water shells; then a layer of matted plants and coal; over this a bed of sandstone; another layer of clay, and again coal, and so on for several successions. Each of these required time for its separate organizations to live, flourish, become immensely numerous, and die, or be destroyed, every stage of life subsisting on the settled ruins of its predecessor. About ten years since, in cutting through the rocks for the Bolton railway, six miles north of Manchester, five fossil trees were found in a position vertical to the plane of the strata. The roots were imbedded in soft clay immediately above a thin bed of coal. Near the foot of one tree lay more than a bushel of clay nodules, each inclosing a cone of *Lepidostrobus variabilis.* The bark of the tree was converted into coal, averaging half an inch in thickness, and the interior of the stem was replaced by shale. The largest trunk measured fifteen and a half feet at the base, and a half at the top, and the fragment was eleven feet high. One tree had large spreading roots, four feet in circumference. By the care of Mr. Hawkeshaw, these interesting remains are covered in and preserved on the spot where they were found.

"Perhaps it may be asked, why were not these islands, endowed with a mild climate and a rich though uniform vegetation, destined for the abode of human beings? The answer is, that it was necessary for the house to be fully prepared before the master was invited to inhabit it—that a country without domestic animals, a field without flowers*, a wood without birds, a climate warm indeed, but probably unhealthy, would be no desirable abode. But I prefer to leave the question unanswered, and to own that, although we are often able to perceive *in little things* the regulation by law which rules in the household of nature, our conclusions become adventurous and faulty when we deal with the grand plans laid down by the Lawgiver of nature; and we shall rather own at once that, with all our cleverness, we are only children feeling our way about."†

The Mountain Limestone at the base of the coal is the scar rock, which makes the scenery on the edges of the coal basins frequently so very picturesque. It is rich in organic remains of corals, crinoids, and shells.

The *Devonian* introduces us into a new group of organic remains, on which volumes have

* This is not now a true picture, for a flower-spike has at length been discovered in the coal-beds.

† Schouw, Earth, Plants, and Man, p. 7. Bohn.

been written, and volumes more may be penned, without exhausting the story of its wonders. There are at least five separate floors of life in the Devonian, represented probably in different localities by land, fresh-water, or marine conditions on the same horizon. In these five ocean platforms occur seventeen species of sea-urchins, no one kind being common to any two divisions.

In the beautiful work by the brothers Sandberger on the Devonian rocks in Nassau, there are enumerated about 269 distinct species of organisms, the delineations of which show not only the exquisite perfection of structural adaptation, but the exquisite beauty of creative ornament.

The Devonian rocks, in the form of old red sandstone, too, exhibit the wondrous fish-remains which, under the poetic pen of Hugh Miller, became invested with sudden but lasting popularity.

There were land-surfaces in those days, for a whole forest of vegetation has left its prints there, with fresh-water shells and bones of air-breathing reptiles.

The Devonian is pre-eminently a passage group between the Silurian and the coal. Vegetation, profuse in the latter, occurs sparingly in the former, just as a premonition. The marine life of the one is connected with that of the other, not by identity of species but by a certain similarity of genera. An observer will

soon learn to distinguish between the two, but will not lose the impression of a general resemblance as compared with other formations.

The Upper *Silurian* yields zoophytes, corals, bryozoa, crinoids, very numerous shells, and trilobites; in the uppermost beds, remains of small, powerful predaceous fish. The Lower Silurians are abundant also in all these classes save the last, though with few exceptions the species are different, and the aspect of the whole group of beings decidedly distinct. The Silurian alum shales of Sweden contain accumulations of seaweed, which now yield valuable economic products.

We find in these rocks the clearest evidences of adaptation in the character of the animal remains of their successive beds. One kind of life flourishes in the fine shales, the consolidated, impalpable mud of the early seas; another affects the coarser sandstone, loving the littoral conditions suited to its existence; a third abounds only in shell sand; whilst the most numerous occupy the calcareous zones, which are the chief sepulchres of the remote past.

The Silurian masses have a wide range, contributing largely to the elevated surface of the globe from pole to pole, everywhere exhibiting similar characteristic fossils. The monarch of shrimp-like creatures, *Pterygotus problematicus*, attained a length of four feet; its companions, the trilobites,

reach their maximum development here; few fishes only have been yet discovered, and rare traces of plants on land surfaces.

The first appearance of every creature in the geological scale is not in a rudimentary or imperfect condition in any sense. Sir Roderick Murchison thus writes of the lowest discovered fish in the Silurian. "But here we must recollect that, when first created, the onchus of the uppermost Silurian rock was a fish of the highest and most composite order; and that it exhibits no symptoms whatever of transition from a lower to a higher grade of the family, any more than the crustaceans, cephalopods, and other shells of the lowest fossiliferous rocks; all of which offer the same proofs of elaborate organisation. In short, the first created fish, like the first forms of these other orders, was just as marvellously constructed as the last which made its appearance, or is now living, in our seas." *

So striking is the sudden addition of life in the seas of the Upper Silurian, that in one band—the Niagara limestone, equivalent to our Wenlock at Derby — 150 new species suddenly make their appearance.

The results of extensive observations in various regions show that marine species had then a wider range than now, so that the climatal and physical

* Siluria, p. 239.

conditions of the ocean over large areas of the globe must have been more uniform than at present. We find even then, however, that particular localities were characterised by *the predominance* of particular species. The trilobite of the lowest fossiliferous rocks in New England (*paradoxides*) is the same that is found in our own primordial zone. The same sea-shells prevailed, from the arctic regions to the equator and Australia.

The Cambrian.—Below the Silurian we find an enormous thickness of slate rocks, long considered as azoic. Their apparent condition in this respect, however, now appears to be more the result of the processes to which they have been subjected than to their formation in the lifeless state of the globe; for minute research in one or two places, as the Longmynd, has discovered amongst the lowest of these some traces of life and vital forces.

The seaweeds of the lower slate rocks, some of the earliest organisms which geology unfolds to us, resemble as a group their successors, which line our present shores.

The Longmynd rocks, which lie at the base of the great system of Silurian life, have yielded to the diligent search of Mr. Salter traces of a trilobite, abundant marks of worms, accompanied by ripple and drainage marks, sun cracks, and rain markings, showing that even down in these

lonely recesses of the past the same power and modes of action were in operation as now. It may be considered as settled, that there is no system of azoic sedimentary rocks.

Every display of intelligence in the works of creation may minister both to the increase of our knowledge and the excitement of devout feelings. Although true piety can neither be created nor supported by such studies alone, yet an intelligent religious habit may find much in geology that is well calculated to gratify and improve the mind. If the enduring works of the Roman, or the rude monuments of the ancient Briton, have charms for the antiquary, irrespective of intrinsic beauty or fitness, how much more attractive should be those relics which are not only connected with the highest associations, but are in themselves manifestations of exquisite, because of infinite, skill!

Among the laws of the distribution of ancient animal life we may state: 1. Its occurrence in definite groups in connection with certain layers of rock. 2. The attainment by each species of a maximum development in one formation, and its being limited in time. 3. Its adaptation to the composition of the masses in which it occurs. 4. The narrowing of the local range of species as we descend in time.

Thus, lifting the curtain of the past, we are struck by the endless procession of animated

existence appearing on the stage, moving slowly across it, and visibly ending not by worn-out life, but by changed conditions.

One source of difficulty in this as in all sciences arises from its terminology. This is altogether conventional. The oolite of one district is represented by an unoolitic rock in another; the sandstone of one by the shale or limestone of another. The groups are intended to comprise certain successions which have a common aspect. This common aspect is either in mineral constitution or in organic remains, or both. Between most of such groups there are passage beds, showing that the extinction of one set of life and the introduction of another was not an arbitrary act, but a process connected with other agencies as means, some of which we cannot now discover.

We cannot announce that there have been absolute life-breaks in the past, for evidence is continually coming in, showing that such lines do not exist, or if existing in one district, do not extend to others.

There are only about half a dozen fossils which, in the enormous Silurian area of North America, pass upwards from the lower into the upper beds; but in Europe the numbers doing so are very great, showing that, within certain limits, the permanence of species depends on local not on general conditions.

We must abandon, therefore, the notion of a succession of universal life-annihilations antecedent to the present. Such processes have been effected by the operation of laws working through ages, under conditions and with immediate object to us unknown. From the first, the method of the Divine government through the agency of second causes has been the same as we now see in operation.

We are apt to connect the idea of miracle with agency greatly more violent than the present; but there is no necessity for this. The course of observed phenomena leads us to expect rather, that in the beginning, as now, God chose to work through the influences in daily employment rather than by unusual acts. The latter have been exhibited in connexion with the establishment of His truth on the earth, its conservation, and the mission of His Son. To these, as marked out by the singular power of the testimony, we should give all heed.

Neither do we find any proofs of a universal physical break at any time. The rule has been progress in detail; here a volcanic outburst and there a tranquil deposition, all slowly working together for the full accomplishment of the Divine purposes.

The study of geology puts to flight for ever the opinion that God has rarely, if ever, been actively employed in creation since the issuing of

his fiat for its commencement. There have been no long periods of inaction, positively no repose whatever of Divine power, no trace of quiescence, no proof of abandonment for a moment. On the contrary, the vast and various provisions for the future welfare of man, the wonderful arrangements for the suitable maintenance of the animal kingdom, the marvellous adjustments of physical phenomena to each other and to life, all show the ceaseless workings of Divine power and goodness.

It refutes, too, the heathen idea of alternate paroxysms of energy and periods of abandonment. Its stony chronicles echo the sentences of the word, saying that "He never slumbereth or sleepeth;" "the darkness and the light are both alike to Him."

Surely we may add, without the charge of incongruity, that if He has thus cared for the material universe from all eternity, so He will for the moral. The traces of continual provision for the one may well be appealed to as tokens of assurance for the other. It is not, therefore, as a stranger that the geologist opens the Word of God. He is prepared for a message which tells him of God's love from before the creation of the world, of His provision for the insignificant and the obscure, of His watch and ward for aye, of the preparations for another advent, even that of the Great Deliverer, of all the resources of salvation,

and of the still future transactions when the sum of the whole shall be declared.

If the heavens are telling the glory of God, if the firmament showeth forth his handy work, and if the earth declares his praise, in regard to their frame and continuance, much more do the facts of redemption declare with emphasis the infinitude of his compassion and love. It is given to man to avail himself of both. The mine deep hidden in the earth, thrown up into access by some ancient pre-arranged catastrophe, will be useless for him, unless he actively explores and wins its treasures. The richer mine of Divine favour to the soul, opened out in God's Word, will be alike unavailing for him, unless he gives himself to the investigation in the spirit of one who has all to gain and eternity at stake.

"And surely it must be gratifying to see a science formerly classed, and not perhaps unjustly, among the most pernicious to faith, once more become her handmaid; to see her now, after so many years of wandering from theory to theory, or, rather, from vision to vision, return once more to the home where she was born, and to the altar at which she made her first simple offerings; no longer, as she first went forth, a wilful, dreamy, empty-handed child, but with a matronly dignity, and a priest-like step, and a bosom full of well-earned gifts to pile upon its sacred hearth." *

* Lectures on Science and Revealed Religion.—WISEMAN.

A review of the domains of former organic life gives us a definite impression of the power of death. Why all this display of successive races which flourished but to decay? Why all this opulence and beauty in adorning the fleeting ephemera of vanishing platforms? Why all this wisdom of structure in machinery so speedily disjointed and laid by? Why the scythe of the destroyer obtruded from the first, and most conspicuous all down the ages? "So it seemed good in thy sight," is all that the humble Christian would say, as with profound awe he contemplates the abounding resources, infinite operations, and inscrutable ways, of his Heavenly Father.

Not alike are the sepulchres of the fossil and the cemeteries of man. The tribes of lower animated nature have had their final development and display; but no one *human* being has ever been lost from the muster-roll of life, or ever will be.

We believe that, in some way, the phenomena of the extinct races are connected with those of the inextinguishable: —

> "The soul's high price
> Is writ in all the conduct of the skies.
> The soul's high price is the creation's key,
> Unlocks its mysteries, and naked lays
> The genuine cause of every deed divine:
> That is the chain of ages, which maintains
> Their obvious correspondence, and unites
> Most distant periods in one blest design."—YOUNG.

CHAP. IV.

HISTORY.

"Where wast thou when I laid the foundations of the earth?"
JOB xxxviii. 4.

IF chronologists are at fault, concerning the correct dates of events which have transpired since the discovery of letters, why should it be expected that certainty can be attained in affixing the waymarks of pre-historic time? The celebrated deduction of Chalmers, that the writings of Moses do not fix the antiquity of the globe, but only that of the genus *man*, has its counterpart in geologic truth; for our science does not fix the positive antiquity of the genus but only its relative age in the earth. Geology has no kingly dynasties by which to index its events, no world-renowned potentate from whose reign to date its progress, but it has its own stately successions and majestic gradations; its own progressive dioramas, every picture of which testifies to the skill and goodness of the Great Artificer. It shows, in ages long past, the flow of years and seasons like our

own, each one bearing the imprint of the Divine goodness, in order that we might afterwards read the long catalogue of his operations, and glorify him "by whom all things consist."

Science can tell us when the epoch of coal measure vegetation ceased, when the age of gigantic reptiles came to an end, when the colossal elephantoid races dwindled and became extinct, when fruit trees and grasses began to appear, when all things tended towards the production of an Eden in the earth: it can tell us of the comparatively modern origin of present species, but of positive chronology it knows absolutely nothing. For that we must resort to history. Of all histories there is but one which has any pretensions to fulfil the task, and that one has irrefutable claims to infallibility.

This being so, we should cease to expect from the Bible the date of the world's origin, or of any event prior to the appearance of man; and we should cease to expect from geology any disclosures as to the chronologies of mankind.

> "Oh, how the human mind wearies herself
> With her own wandering, and, involved in gloom
> Impenetrable, speculates amiss!
> Measuring, in her folly, things divine
> By human; laws inscribed on adamant
> By laws of man's device; and counsels fixed
> For ever, by the hours that pass and die."
>
> COWPER, *from Milton's Latin Poems.*

But we may, in a general sense, seek to corroborate the one record by the other, and, with this view, we feel that one of the desiderata in geology is to define the limits in the scale of the past within which the present state of things commenced.

We can show that the existing configuration of land and water obtained ever since the time which history records. The positive volume and level of the Nile, Euphrates, Mediterranean, and Red Sea, have evidently remained materially unaltered for upwards of three thousand years.

From the mention, after the flood, of localities spoken of before, from the tenor of references to the earth "that then was," and from geological inductions from the effect of causes still in operation, we conclude that there has been no substantial change, though constant small oscillations, as it were, of land and water, both in height and breadth, since the time when "God saw everything that he had made, and behold it was very good."—Gen. ii.

The present assemblage of animated life can be carried back to the date of the six days' creation.

It can be shown, by good negative evidence, that man belongs not to either of the three great preceding life-periods. Sadly bereft would he have been amidst the ocean life and agitations of

the palæozoic strata; quite at a loss on the low islands of the coal vegetation, unsuited for food or shelter; altogether unprovided for by the brine springs of the trias, where huge labyrinthodons squatted on the dull shore; nor in the earlier liassic days could he have been fit companion for monstrous saurians; nor in later triassic either, though its lands were fringed with palms, for there lurked the mighty iguanodon. The islets of cretaceous seas would have afforded no fitting place for him. Sorely beset would he have been amidst the mammoths, mastodons, megatheriums, and elephants of the tertiary; altogether out of place, in these parts, during the glacial period preceding his actual advent.

"We are now," says Cuvier, "in the middle of at least the fourth succession of land animals. After an age of reptiles, another of mammoths, mastodons, and megatheriums, there has arrived an age in which the human species, aided by domestic animals, governs and peaceably improves the earth." The arrangement of the surface, in the latter tertiary times, had become varied by patches of land, fresh water, and ocean, alternately dotting the surface, as at present; and this, too, by a process which was simply in continuance of foregone geological phenomena in each case, not the result of one huge cataclysm.

It is, therefore, next to impossible with regard

to several of the alluvial gravels and soils, to say whether they are pre-historic or not.

There is nothing however in geology at variance with the fact that the creation of man on the earth took place 4004 years B.C. Science shows that all things were ready, and then, reverently turning to Scripture, we read that "the Lord God formed man of the dust of the earth, and breathed into his nostrils the breath of life, and man became a living soul."—Gen. ii. 7.

An elaborate attempt has lately been made, by an accomplished Romanist writer, to prove that the work of creation, spoken of in the first verse of Genesis, is the work of the six days, and not the retrospect of a former world; that all species of plants and animals, both fossil and recent, were created at once.*

Reference to facts, so often quoted in this controversy as to be familiar even to weariness, will suffice to show how untenable is this representation, and, therefore, how it must, if persevered in, prove injurious to the cause of truth.

Let me take the reader to a low, crumbling cliff, on the Suffolk coast, apparently a mass of loose sand and gravel. To the casual observer it

* Cosmogonie de la Bible, par M. l'Abbé Soignet: Paris, 1854.

would appear to present no obstacle to the theory of the learned Abbé. A tumultuous rush of water, charged with sand and sediment, will account for all. A narrower inspection discovers the following state of things.

First, at the base of the cliffs is a bed of dark clay containing shells of mollusca, once inhabiting freshwater pools. Above this is an irregular surface, covered with the roots and stumps of furze bushes, like a brake that has been cut but not rooted. Over this is a dark brown layer of matted rushes and grass-like plants, forming peat. Upon this rests ten feet of brown sharp sand, with small pebbles and scarce fragments of shells, now found in the arctic seas. On this is twenty feet of yellow sand. Next occurs an irregular large mass of dark clay, spotted with numerous fragments of chalk, and full of pieces of old rocks, from the large boulder down to the tiny fossil. In these transported materials, I found rolled fragments of granite, red and white, porphyry, basalt, greenstone, slate, Silurian rocks, mountain limestone and coal grit, permian, red sandstone, lias, oolite with abundant fossils, and chalk, with its fossils most numerous of all. This is surmounted by ten feet of pebbly gravel and sand, principally flint; and this again by recent soil. On this spot we are therefore com-

pelled to conclude, that there have happened the following succession of events:—

1. Small pools, in which freshwater shells and weeds grew, and clay accumulated.

2. A land surface, on which grew a thick brake of furze.

3. The brake became a marsh, and was covered with rush-like plants.

4. This became a sea-beach, on which fine sand slowly accumulated, partly by drifts, inclosing broken shells of a frigid ocean.

5. A turbulent rush of viscid mud charged with fragments of stone, partly rolled, torn off from rocks of Scandinavia or Scotland, and augmented by large additions in its southward progress.

6. A beach on which sand and pebbles alternated, with tidal and other unequal forces at play, causing appearances the same as on the modern strand beneath.

7. The whole mass raised as the successive platforms require, and finally lifted into its present position, before the formation of the existing soil.

The growth of animals and vegetables, the attrition of rocks, their disposition in regular strata, are operations requiring long periods for their accomplishment. No ingenuity can construct a hypothesis in view of the facts which shall possibly account for their occurrence within six days or six

years. What can be said then when it is added that all this relates merely to one of the minor subdivisions of the geological scale,—the drift or boulder clay period, a mere interlude in the post-pliocene epoch, not the hundredth part of the whole series? A similar analysis of other portions of the great succession would show still greater difficulties in the application of the theory of the worthy Abbé and his numerous coadjutors.

It is no longer possible to resort to such attempts to conform the findings of science to the notions of those who are wise beyond what is written.

"Geology," says the Rev. W. S. Symonds, "may be likened to a large book with many leaves and closely printed lines. The student turns page after page, until the eye wearies and the brain wanders amidst the revelations of the past: he looks at last for man's track, man's first appearance, and *less than a single line* of those closely printed records of the planet's history will suffice for all the human generations that have existed under the sun." *

Those who will prosecute science as the ally of religion, and not as its enemy or its substitute, will occasionally find themselves misunderstood and repulsed. But it is ever the fortune of truth

* Stones of the Valley, p. 241.

to be first scorned, then tolerated, and next embraced.

At the present day the world is in dutiful attendance on the mission of science; let all her behests be gladly welcomed, save when she attempts to create new religion or new morals. No fear need ever be entertained of any real discord between the word of God and the works of God. We may fail as interpreters on the one hand, or as observers on the other, but there is absolute unity, whether within our ken or not.

The chronology of history, as corrected by one who is giving to the subject the labours of a learned life *, is as follows: —

	A.M.
1857 (October)	6000
Destruction of Jerusalem	4213
Crucifixion	4176
Birth of our Lord Jesus Christ	4142
Death of Alexander	3821
Release of Jews by Cyrus	3584
Sack of Jerusalem	3514
David king	3000
Fall of Troy	2917
Exodus	2453
Ninus the younger	2000
Semiramis	1958
Abraham born	1948
Ninus	1906
Belus	1844
Nimrod	1788
The Deluge	1656

* The Rev. Franke Parker, MSS.

	A.M.
Noah born - - - - -	1056
Enoch translated - - - -	987
Lamech - - - - - -	874
Methuselah - - - - -	687
Enoch - - - - - -	622
Jared - - - - - -	460
Mahalaleel - - - - -	395
Cainan - - - - - -	325
Enos - - - - - -	235
Seth - - - - - -	130
Adam created - - - -	(B.C. 4142)

Geology with its myriads of objects does not show us any human traces prior in date to the historical records. No monuments, telling us of a pre-adamite race, have been announced; we may safely conclude none such exist. Immediately on quitting the record of Moses and launching into the ocean of previous time, we are as a voyager who is without an index and has to measure time only by events. We find proofs of tidal, diurnal, and annual movements, of generations of animated existence, of convulsion and tranquillity, of deposition and consolidation. One cemetery after another, all containing the exuviæ of distinct races, show the occurrence of successive life — periods which soon overwhelm us by their numbers, and we give up in despair the task of constructing any chronology save that which simply registers the relative position of the great members of the mighty series. We say with the Patri-

arch, "Behold God is great, and we know him not; neither can the number of his years be searched out." * The difficulty is not in the subject, but in our inadequacy to conceive of the immense duration required. We can estimate with tolerable certainty the time needed for the formation of a layer of coal and a layer of sandstone, and then by multiplying arrive at the ages requisite for the production of a whole series of coal measures like that of the Joggins, in Nova Scotia. In this place, there is a range of perpendicular cliffs on the coast, composed of regular coal, all parallel, varying from two inches to four feet in thickness. At more than ten distinct levels in the series there are stems of trees, each originating in a coal seam, all upright, with reference to the floor on which they grew, all cut off by the layers of mud and coal above. The trees are hollow and the bark has become coal, the interior filled with sand. Here are then the unequivocal remains of ten distinct forests, which grew at ten distinct intervals on the same spot, and between the interval each in succession became covered with clays and sands, which were deposited under water and then consolidated into stone. Such instances might be cited from nearly all the known deposits of coal; the latter evidently owing much of its present character to alternate changes of dry land and water: the ocean or lake-bed becom-

* Job xxvi. 26.

ing a vegetable soil, sustaining its noble burden of foliage, then sinking with it into the deep, the waters again resume their dominion, the marine creatures live, die, and are entombed —

> "And thy majestic groves of olden time
> Perished with all their dwellers."

Again the platform is raised, and the scene slowly changed into the present appearance of things.

It has been computed that the woody matter contained in the growth of a thousand years, in a dense tropical forest, would not constitute a layer of mineralized fuel half an inch in thickness. How is it, then, possible to assign to the present rate of agency of causes now in operation, the production of the numerous beds—some whose thickness is measured by many feet—existing one over another, in the actually explored districts of our coal formation?

Our powers fail us in the attempt to conceive of the lapse of time demanded for the whole periods of the geologic scale. The formulas would be like the figures of stellar astronomy, utterly unintelligible, save as conveying the notion of graduated immensity. We can conceive of planetary spaces somewhat more distinctly by the aid of the measurements of geometry within the field of observation; we must be satisfied with some such

general aid to our conceptions of ante-human time afforded by the monuments rising out of the darkness of the past. "The whole period, from the beginning of the primary fossiliferous strata to the present day, must be great beyond calculation, and only bear comparison with the astronomical cycles, as might naturally be expected; the earth being without doubt of the same antiquity with the other bodies of the solar system."*

If we demonstrate that the earth was occupied by animated existences long before the chaos out of which God evoked the present creation, then there can be no longer any reason for surprise at the lengthened durations demanded by the geologist. We have no record to synchronise with the facts; no lessons to humanity were connected with the purposes, save those which are "graven in the rock for ever." The mind is baffled in the attempt to conceive of the flow of ages whilst the work of preparation was proceeding. Still farther back do the sacred writers lead us, overpassing all that geology in its farthest flights demands, and introducing us to the existence of God ere the world was.

"The Lord possessed me in the beginning of his way, before his works of old. I was set up from everlasting, from the beginning, or ever the

* Mrs. Somerville, Physical Geography.

earth was. When there were no depths, I was brought forth; when there were no fountains abounding with water. Before the mountains were settled, before the hills was I brought forth: while as yet he had not made the earth, nor the fields, nor the highest part of the dust of the world. When he prepared the heavens, I was there: when he set a compass upon the face of the depth: when he established the clouds above: when he strengthened the fountains of the deep: when he gave to the sea his decree, that the waters should not pass his commandment: when he appointed the foundations of the earth: then I was by him, as one brought up with him: and I was daily his delight, rejoicing always before him; rejoicing in the habitable parts of his earth; and my delights were with the sons of men."*

We have got far back into the ages; science, with its revelations, is now far behind; we have only the simple word of God, as our instructor and guide, and before us the eternal.

"We aspire in vain to assign limits to the works of creation in space, whether we examine the starry heavens, or that world of minute animalcules which is revealed to us by the microscope. We are prepared, therefore, to find that in time also the confines of the universe lie be-

* Prov. viii. 22—31.

yond the reach of mortal ken. But in whatever direction we pursue our researches, whether in time or space, we discover everywhere the clear proofs of a creative intelligence, and of his foresight, wisdom, and power."* Recent salt lakes show deposits of three feet in thickness, which have probably been accumulating ever since the origin of the present surface, but the Cheshire rocksalt beds, deposited in the same manner, during the triassic era, are 100 feet thick!

If there were no organic fossils in existence, the proof of succession would only be less complete, but would not be wanting. Nay, if there were no evidence of the superposition of mineral masses, the veins and faults in rocks would still show the lapse of ages in the structure and consolidation of the earth. There are some few analogous phenomena at work at present in the filling up of fissures with crystallized mineral substances, but they are wholly inadequate for comparison with the gigantic operations which have yielded us our mines. Metallic lodes are not of contemporaneous origin with the rocks they traverse; the latter must have become consolidated and then rifted, then subjected to the action of hot gaseous fluids, again cooled down, again rifted and exposed to a second system of

* Lyell's Principles, p. 799.

violent action and deposition, and so for many successions until they became duly charged with the minerals, or until the latter became aggregated so as to become separately visible and obtainable by the industry and art of man. Not so attractive are the proofs of long periods of time, which are written in the metalliferous strata, as those which abound in the fossiliferous rocks, but their severe records are capable precisely of the same interpretation. Upon a survey of the modes of occurrence of minerals, the candid observer must conclude that the earth was in existence for ages before the creation of man. Nor is this conclusion at variance with any declaration of Scripture, when the latter is studied with the same regard in its interpretation to the scope and context as is given to other subjects of revelation.

Just as we should learn much of the history of England by tracing the fortunes of one of our aristocratic families backward to the Norman man-at-arms who came over with the Conqueror, so we may obtain a lively impression of the sequences in the geologic past by tracing the fortunes of any family which has survived from the earliest times to the present, in the palæontological roll.

In the bays of Polynesian coral reefs there now dwells a tiny molluscous creature, protected by a

thin bivalve shell, named Lingula. It has no distinct head, but a notable mouth, whence spring two long arms, fringed throughout with delicate cilia spirally disposed. The cilia are the agitators which sweep currents of sea-water, whence the little creature obtains respiration and nutrition. Its intelligence is energized and expressed by a nervous collar. All its life long, after infancy, it is moored by a short cable, extending from between its shells, and made fast to some rock or gigantic sea-weed. Thus it lives, like other illustrious obscurities, the centre of a small circle, occupying itself in collecting, selecting, enjoying, and digesting. Beautiful is the little thing as it rides at anchor, in its emerald grot, shaped like a gondola, exquisitely pellucid and delicately coloured. The mechanism of its valves, the life-organization of the whole, find a hundred corresponding adaptations in the sea around. All things with which it naturally comes into contact have evidently been constructed for *it*; nothing is transgressive to the law of its being. So it and its progenitors have lived in unbroken succession from "the time whereof the memory of man runneth not to the contrary." Beyond legal memory, whose boundary is the departure of brave Cœur-de-Lion to the crusades—beyond Herodotus, the father of history—from before the voyage of the good ship Argo, it has been living and flourish-

ing, unknown to fame. Amidst the turbulence of the Flood it lived, and may have attracted the attention of the world's grey fathers in their boyhood. But it claims a still higher ancestry, for we find it in pre-historic times. Separated by a long interval from the earliest indications of man, we find it among the crag shells of Suffolk. Evidently the same kind of creature is it; still a Lingula, though as it were but a cousin, with the true family features. Again ascending the stem of its genealogy, we find it in the warm regions of eocene life, when the oceans and islands were like those of the eastern archipelago at present. The cretaceous period, too, shows us our little shell, ranking with the elegant forms of the lower greensand fossils. Upwards still, in the region of the oolites, it takes its place with the coral then growing over the new-made grave of the gigantic saurians. What became of it, in what unknown seas it took its refuge whilst the coal forests were alternately flourishing and decaying, we cannot conjecture; but on again entering a zone of purely marine life in the mountain limestone, there we find it in its accustomed association. It was even then one of the oldest inhabitants, for we discover it in the Devonian and Silurian rocks. Most of the well-marked stages of Silurian life abound with its remains. The upper and lower Ludlow, and the Aymestry limestone, have

many species. Much more considerable was it then than now in relative importance. We have dropped off many families, and whole tribes in our backward flight; but we must still press on, though with greatly diminished retinue, for the little Lingula ascends to the utmost limit of organic life, and is found where *any* traces of vitality are first discovered, in beds which constitute the primeval zone, and which by a proper act of heraldry have been styled the Lingula flags. There are thirty-four species of these little creatures found fossil, and only seven recent. It is decidedly an old-fashioned form.

Geology, which would be a dismal labyrinth if it exhibited no proofs of order and design, becomes, with these kept in view, an illustrated volume of rare interest. By its aid we carry back into untold ages the evidences for God, which the naturalist so triumphantly gathers from the creation around. We cannot deny to the witnesses from the tombs the same credit we give to those from the market-place.

Palæontology and mineralogy both tell us that the world has a history not recorded, because not professed to be recorded in the Scriptures; and that the great actor in this history was unquestionably God, "blessed for evermore." He has in the Bible given us adequate information to make wise unto salvation, but has left for the present untold

much of the great story of his love; that we may hereafter learn it, when the necessities of our present condition shall no longer impose restraints on our investigations; when all knowledge shall be sanctified. "When that which is perfect is come, then that which is in part shall be done away."*

We should ever remember the truth expressed by the pious author of "Clavis Bibliorum," in 1647: "The scope of Genesis is to set forth the generation of the world; the corruptions thereof by sin; the restoration thereof by Christ." The student who would venture on the ocean of human philosophy never need discard the compass of the Divine Word, though he voyages into regions unknown. With the compass aboard he may still navigate in security, for he will nowhere find a place where its direction will swerve, or its action fail. "Of him, and to him, and through him are all things." But he must not expect from his compass more than its cardinal points are constructed to indicate, seeing that it has been framed by the great Omniscient.

* 1 Cor. xiii. 10.

CHAP. V.

EXPOSITION.

"In the beginning God created the heaven and the earth."—*Gen.* i. 1.

MAJESTICALLY simple and comprehensive is this sentence; we feel that nothing can be added to it, or taken from it with advantage. Elsewhere, in Scripture, the same truth is announced. "He stretcheth out the north over the empty place, and hangeth the earth upon nothing." "The pillars of the earth are the Lord's, and he hath set the world upon them."—*Psalms.*

Dr. Harris well expresses the conclusion that many wise students have come to respecting the scope of this passage. He says: "From a careful consideration of the subject, my full conviction is, that the verse just quoted was placed by the hand of inspiration at the opening of the Bible as a distinct and independent sentence; that it was the Divine intention to affirm by it, that the material universe was primarily originated by God from elements not previously existing; and that the originating act was quite distinct from the act in-

cluded in the six actual days of the Adamic creation."*

Apart from the record, we have the proofs of the occurrence here of a vast interval, altogether unnoted in the sacred volume; an interval in which all pre-historic geology finds its place.

> "And the earth was without form and void; and darkness was upon the face of the deep."—*Gen.* i. 2.

We have seen, in previous chapters, how the remote past, with all its accumulated stores, is brought down to the gate of the present; but not yet is it to be introduced and inaugurated. As though to exclude evermore the argument which would educe the latter from the former by some inevitable process, there is to be an intermediate condition of darkness and apparent ruin, which shall render the creative power of God the more striking and illustrious. In verse 2 is contained the statement that the surface of the earth became in a disordered condition. Geology reveals to us that this was not a phenomenon preceding all order whatever, but a marked interruption in the sequence of physical events. Scripture teaches us that it was preparatory to the present creation. We may reverently say, that "it became Him by

* Pre-Adamite Earth, p. 83.

whom are all things, and for whom are all things," that there should be an introductory condition of darkness and apparent chaos ere the glorious work was fully entered upon. "Now, whereas the antecedent darkness did continue for some time on the face of the deep, wherein the Spirit of God moved upon it, it may be curiously inquired how long that space of time was wherein the antecedent darkness was and continued before the first light was created? But as Divine wisdom doth not regard human curiosity, nor attend to satisfy it, so I esteem it impertinent."*

The geologist tells us that this might have taken place at any time during the remote past. Its vast cycles have witnessed several augmentations of creation, and several periods in which the earth may, for aught that appears, have been, in the expressive language of Wiclif's version, "idil and voyde." But it does not tell us what particular set of post-tertiary phenomena accompanied this event. The present creation is immeasurably a greater augmentation of the past than any one preceding. We learn from the Word of God, that it was ushered in by an appointment which looks like an abandonment of the fair earth to darkness and ruin.

The nature of geological discoveries is such as

* De Gotte on Genesis, 191.

to permit, if not demand, the intervention of epochs of absolute change. Though no stratum is found continuously all the world over, and we have no *proof* of a universal catastrophe in the records of the earth beneath, yet there are appearances which may have been occasioned during such an event; there is nothing to contradict it, or to render its occurrence impracticable. Frequently may the geological observer recognise the character of God in the aspect noted by the prophet Amos: "Him that maketh the seven stars and Orion, and turneth the shadow of death into the morning, and maketh the day dark with night: that calleth for the waters of the sea, and poureth them out upon the face of the earth: The Lord is his name."—Amos v. 8.

"And the Spirit of God moved upon the face of the waters."—v. 2.

Divine energy is now put forth for the commencement of the present state of things. This differs, as a whole, so much from any antecedent condition, that it can well be called a new creation. It is not a term in any established progress merely, but a new work, having a certain orderly correspondence with the previous manifestations, but altogether surpassing them. There is an approximation from the first towards the present, as though all through the ages the latter had been the

appointed ultimatum of terrestrial physical life in the estimation of the Lord and Giver of life, and so all prior developments shadowed and in part shaped out of the finished result. The actual is not merely the possible, but it is the planned and prefigured.

Well does good Andrew Fuller write—"The account given by Moses relates not to the *whole creation*, but merely to what it concerns us to know. God made angels, but nothing is said of them. The moon is called one of the *greater* lights, not as to what it is in itself, but what it is to *us*. The Scriptures are written, not to gratify curiosity, but to nourish faith. They do not stop to tell you how, nor to answer a number of questions which might be asked; but to tell you so much as is necessary and no more."

"And God said, Let there be light: and there was light.

"And God saw the light, that it was good: and God divided the light from the darkness.

"And God called the light Day, and the darkness he called Night. And the evening and the morning were the first day."—v. 3—5.

Light was now made to appear: *first* as to the darkness out of which it immediately sprung, and *first* with reference to all that of which it was the introductory manifestation. The mandate is

a future one, and loses none of its sublimity by the recollection that the glorious thing was existing elsewhere, beyond the darkness, and had even reigned here in the antecedent ages of elaborate preparation; nor does this interpretation weaken the reference made by the apostle to this great miracle, in order to illustrate the mode of regeneration:—"For God who commanded the light to shine out of darkness hath shined in our hearts, to give the light of the knowledge of the glory of God in Jesus Christ."—2 Cor. iv. 6.

"And God said, Let there be a firmament in the midst of the waters, and let it divide the waters from the waters.

"And God made the firmament, and divided the waters which were under the firmament from the waters which were above the firmament: and it was so.

"And God called the firmament Heaven. And the evening and the morning were the second day."—v. 6—8.

On the second day, the present atmospheric arrangements were restored and developed. The rain-drop had fallen from the first; differences of climate had been produced long before; but out of the condition of disorder and dark miracle of verse 2, now again were evolved, at the fiat of the Almighty, the play of the great system of

exchange, whereby the clouds "drop down fatness."

"And God said, Let the waters under the heaven be gathered together unto one place, and let the dry land appear: and it was so.

"And God called the dry land Earth; and the gathering together of the waters called he Seas: and God saw that it was good.

"And God said, Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after his kind, whose seed is in itself, upon the earth: and it was so.

"And the earth brought forth grass, and herb yielding seed after his kind, and the tree yielding fruit, whose seed was in itself, after his kind: and God saw that it was good.

"And the evening and the morning were the third day."—v. 9—13.

The third day. The present geography of the earth's surface made apparent, and then the creation and growth of vegetation in soils which had been prepared in previous pre-historic epochs.

"And God said, Let there be lights in the firmament of the heaven to divide the day from the night; and let them be for signs, and for seasons, and for days, and for years:

"And let them be for lights in the firmament of the heaven, to give light upon the earth: and it was so.

"And God made two great lights; the greater light to rule the day, and the lesser light to rule the night: he made the stars also.
"And God set them in the firmament of the heaven to give light upon the earth.
"And to rule over the day and over the night, and to divide the light from the darkness: and God saw that it was good.
"And the evening and the morning were the fourth day."—v. 14—19.

The unveiling, in the now lucid atmosphere, of the sun, moon, and stars, in perpetual connection of forces and influences with the earth. Not the original establishment, but the first manifestation as regards the earth's present surface.

"And God said, Let the waters bring forth abundantly the moving creature that hath life, and fowl that may fly above the earth in the open firmament of heaven.
"And God created great whales, and every living creature that moveth, which the waters brought forth abundantly, after their kind, and every winged fowl after his kind: and God saw that it was good.
"And God blessed them, saying, Be fruitful, and multiply, and fill the waters in the seas, and let fowl multiply in the earth.
"And the evening and the morning were the fifth day."—v. 20—23.

We have here narrated the creation, as a whole, of the present assemblage of aquatic animals and of birds. They were vastly more numerous, diversified, and useful, than the animals of any previous epoch.

It is owing to the creation of everything "after its kind," both in this and in the previous stages, that we can advance with unfaltering footstep into the domains of the dead, to pronounce with confidence concerning the true character of the relics. We find around us distinct forms, not derived through any transmutation of species from others, nor themselves the progenitors in any such fabulous descent. The creatures whose origin is recorded in these verses, not only exhibited the same master-hand as their predecessors, but the same master-mind, inasmuch as both formed consistent parts of one harmonious whole. Among the most antique things we can gaze upon are the familiar *forms* of the creatures around us. In unvarying similitudes have they been preserved and transmitted from the first.

> "But changeful and unchanged the while,
> Your first and perfect form ye show;
> The same that won Eve's matron smile
> In the *world's opening glow.*" — KEBLE.

"And God said, Let the earth bring forth the living creature after his kind, cattle, and creep-

ing thing, and beast of the earth after his kind: and it was so.

"And God made the beast of the earth after his kind, and cattle after their kind, and everything that creepeth upon the earth after his kind: and God saw that it was good.

"And God said, Let us make man in our image, after our likeness: and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth.

"So God created man in his own image, in the image of God created he him; male and female created he them.

"And God blessed them, and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth.

"And God said, Behold, I have given you every herb bearing seed, which is upon the face of all the earth, and every tree, in the which is the fruit of a tree yielding seed; to you it shall be for meat.

"And to every beast of the earth, and to every fowl of the air, and to every thing that creepeth upon the earth, wherein there is life, I have given every green herb for meat: and it was so.

"And God saw every thing that he had made, and, behold, it was very good. And the evening and the morning were the sixth day."—v. 24—31.

This informs us of the creation, as a whole, of the living species of reptiles and animals, and, lastly, of man himself. The end crowns the work. Our science, in none of its marvellous revelations, can bring into comparison any such marvel as man. The lord of the lower creation, not by structure, but by endowments, as a fossil he would exhibit no trace of the immense elevation to which he has been promoted by being made "in the image of God." *

The whole *mode* of the divine revelation, concerning the origin of things, can be shown to be congruous with mental liberty in the pursuit of truth, and also with the assumption of a pervading intelligent belief in God. So the whole *mode* of the Divine manifestations in geology can be shown to be congruous with the discipline of man on the earth. Looking at the great and difficult truths of our science, we point to the Bible, and say—

"God is his own interpreter,
And he can make it plain."

He has done so, not by gratifying our curiosity

* For a critical examination of the philology of the question see "Genesis and Geology, by Denis Crofton, B.A.," Kittow's Journal, 1850; reprinted in America and here. A most able, devout, and exhaustive work.

in things needless for our spiritual welfare, but by giving us materials for certainty in faith and conduct, and leaving much of the objective world as the legitimate province of our lawful investigations and devout but unaided study.

In the second chapter of Genesis we have a summary of the work of creation as relating to the present condition of the earth, with special reference to the appointment of a day of rest, and the primeval history of mankind. The second verse states, the rest of God on the seventh day. A fact which is, by Divine appointment, the foundation of the Sabbath, and, by the same appointment, typical of the everlasting rest of the people of God.—Heb. iv.

In a scientific point of view, this passage appears to be confirmatory of the conclusion derived from natural history, that no new species nor any new substance has been created since the period here indicated. We have before us, in the universe, a definite state of things, whereon to exercise our faculties and ground our actions. Never can we be embarrassed by the addition of unexpected conditions or affected by the disturbance of existing order. "All things continue as they were from the foundation of the world."

The globe has been ransacked in the anxious search for all its treasures, but, although "God is able to raise up out of these stones children

unto Abraham," yet never has he disturbed the original creation, which was crowned when he made man. The same power which has been continually exercised for its maintenance might, at any moment, have spoken into life new races of being.

There is deep importance in the consideration of the finality of the present condition of things. Geology proclaims the sufficiency of the material provision made for the physical education and maintenance of man; all other natural sciences attest the same. The moral sciences utter the like general truth concerning the full adequacy of reason with revelation, for the moral well-being of mankind. On every side we are shut up to the present and practical. Enough is there in the world for the wants of man in every sense, as well individually as socially. Let us, with humble, penitent, and believing hearts, apply ourselves to the study of the pregnant truths within our reach, since they are sufficient for our well-doing here, and our well-being for ever.

In verses 4, 5, of the second chapter, we are again told that God created every plant before it grew, and that it grew before rain was, and before man was. Ere the sun became apparent in the firmament, a heavy mist had supplied the vegetation with the requisite moisture.

In Exodus ii. 10, 11, we have a reference to

the same series of acts constituting the six days' creation: "For in six days the Lord made heaven and earth, the sea, and all that in them is."

The true character of the revelation made to us concerning these things is admirably expressed by the present Archbishop of Canterbury:

"The account of the creation given by Moses, does not profess to furnish anything like a systematic or elaborate detail of the mode in which the materials of the earth were brought to their actual form and situation. The warmest lover of geology would scarcely expect to find this in the record, the very terms in which such an account could be expressed requiring an advanced state of science; and the information, when conveyed, being altogether unprofitable as to those uses which are the proper objects of revelation. To know his connexion with the Creator and moral Governor of the world is necessary to the virtue and happiness of man. To investigate the regular laws to which the created world conforms, or the process by which it was reduced to that obedience, is a delightful exercise of the reason he possesses; but is totally unconnected with those higher interests which a revelation has in view."*

Those who expect to find a full historical account of the creation in the Bible, forget that

* Records of the Creation.

it is given to us for no such purpose, but solely in order that we may know the true God, and Jesus Christ whom he hath sent. Its historical statements are confined to the setting forth of so much as is requisite to explain the necessity, and vindicate the method, and enforce the teaching of the Saviour's work and mission. The devout student will, however, rightly expect that all its revelations, however slender on some topics, should be found to be consistent with the discoveries of science. It is the delightful task of able scientific men to show that this is so; every year adds to the augmenting store of such proofs, and thus swells the triumphant song, which may well arise from all the domains of human learning, "This God is our God for ever and ever!"

As geologists, we find nothing in nature to prevent our taking the account of the creation, literally, in the order given; viz.—1. The creation of all things by God. —2. The bereft condition of the earth just previous to the present epoch. —3. The Divine energy put forth for its orderly replenishment.—4. The manifestation of light, and of the diurnal period.—5. The clearing of the atmosphere.—6. The establishment of the present general geographical boundaries, by the cessation of causes which had produced encroachments by the sea on the land.—7. The newly emerged lands clothed with vegetation.—8. The

appearance of the heavenly bodies through the atmosphere, now cleared from excess of vapour. 9.—The creation of new species of marine life, in addition to such as had survived the previous change, and of birds.—10. The creation of land animals, such creations being altogether by miracle, and simultaneously at many points on the earth's surface.—11. The creation of man. The microcosm of the whole work.

That there are difficulties connected with the subject is undoubted. There is no interpretation in which all will concur, nor is it necessary that there should be. We can ask only for a reasonable certainty; had unanimity been essential to our welfare doubtless it would have been provided for. There are no difficulties whatever connected with the great initial truth, which alone concerns us in our present condition,—the truth that God is the Creator, Preserver, and Governor of all. "God that made the world, and all things therein, seeing that he is Lord of heaven and earth, dwelleth not in temples made with hands; neither is worshipped with men's hands, as though he needed anything, seeing he giveth to all, life, and breath, and all things." "For in him we live and move and have our being." "For we are also his offspring."*

Our relation to him being thus established, we receive with reverence such portions of truth

* Acts xvii. 24—28.

concerning matters non-essential to our immediate welfare as he pleases to communicate, waiting, with tranquil expectation, for the fuller manifestations of that state where we shall see not through a glass darkly but face to face; when those who have availed themselves of the truth that, as "there is one God, so there is one Mediator between God and man," shall, through that blessed intervention attain to the fruition of all knowledge and the sum of all joy.

One thing is clear, namely, that the present condition of mankind being one of probation, all God's manifestations to man have been made on this ground. Not only is the word of God based upon the present moral necessities of man, but the works of God are so arranged as to subserve the accomplishment of the remedial and restorative processes. The trust and confidence, the faith and hope, the patience and obedience, into which our minds are brought by the operation of the Holy Spirit through the Word, find a counterpart in analogous feelings, which a devout consideration of the works of God invariably produces. On a large scale, all that we can ascertain and know of the unseen, is adapted to bring and keep us in humble dependence on our heavenly Father, whose glorious character as Creator is accompanied by his gracious attributes as the Giver.

If it should be objected to the whole course of this exposition, that it avoids the difficulties only by

evading them, we reply that it is not so. We acknowledge them, and then suggest an interpretation which does no violence to the scope of scripture, and is not more at variance with the letter than the acknowledged readings of other passages on whose meaning all agree. We may add in the glowing words of the "old man eloquent," the Woodwardian professor, — "The only way to escape from all difficulties pressing on the question of cosmogony has been already pointed out. We must consider the old strata of the earth as monuments of a date long anterior to the existence of man and to the times contemplated in the moral records of his creation. In this view there is no collision between physical and moral truth. The Bible is left to rest on its appropriate evidences, and its interpretation is committed to the learning and good sense of the critic and commentator: while geology is allowed to stand on its own basis, and the philosopher to follow the investigations of physical truth, wherever they may lead him, without any dread of evil consequences, and with the sure conviction that natural science, when pursued with a right spirit, will foster the reasoning powers, and teach us knowledge fitted at once to impress the imagination, to bear on the business of life, and to give us exalted views of the universal presence and increasing power of God." *

* Discourse on the Studies of the University.

CHAP. VI.

EXPOSITION CONTINUED.

The Flood.

GEOLOGISTS now tell us that their investigations do not disclose any traces of the scriptural deluge. Countless are the diluvial effects shown by the old gravel beds and conglomerates, but no one of these can be singled out as having occurred only 4143 years ago. They also tell us that such a catastrophe, even if universal, would not leave any trace of its occurrence which would record its tale of ruin in characters distinguishable from the traces of floods, which have swept over many lands within historical times.

The sediments of 150 days, if discovered on the present land, would be capable of identification only by means of the remains of antediluvian life preserved amidst the wreck. None such have yet been discovered, and we are consequently in ignorance whether the sin-flood buried the spoils of the ungodly under the waves of the present ocean-beds, or amidst recesses of the lands yet unexplored. But the men of science claim to be heard on

another point, namely, whether the Word teaches a universal destruction of life on the earth, or only a destruction of that which was universal with reference to its occupation by mankind in those days.

No bounds can be assigned to the Almighty power of God; if the language of Scripture, interpreted according to rules to be drawn from the Word itself, cannot be satisfied without implying an amount of miracle sufficient for submergence, death, and restoration over the whole earth, of animal and vegetable life, within forty weeks, we bow before it and acknowledge the miracle. But our knowledge of the modes of the Divine government, even in the matter of miracles, leads us to expect that the act would have reference to the object, and that a re-creation more marvellous than the first would not be resorted to unnecessarily. Our doubts will be much strengthened by reflecting on the present distribution of animal and vegetable life, which cannot have originated in one place, but must have simultaneously commenced in a thousand places; for nothing is better established than the existence, throughout all historic times, of distinct life-provinces, both botanical and zoological. Add to this the difficulty of conceiving how animals could have lived, especially those mutually destructive of each other, in the early days of such dispersion; and how plants capable of

existence only on different soils, climates, and aspects, could have been centered in one area.

Nor does geology tend to remove these doubts, but, on the contrary, establishes most emphatically the fact that in the old world there were life-provinces as distinct as in the new; and, further, that such life-provinces were approximating to the present on the eve of the actual historic period.

The depths of air and sea, the slopes of mountain ranges, the meadow and the desert, the salt-marsh and the upland, the jungle and the prairie, the island and the continent, are now diversified by permanent variety in vegetation originally adapted to its present habitat, and we cannot conceive of it otherwise without an amount of subjective change greater even than the advocates of transmutation demand. This is not only the case with the great groups of life, but with all the minor assemblages; as any observant person who has either travelled or read travels will readily grant. Whilst there is a general distribution of life regulated by the local amount of light and heat, there is also a special distribution regulated by more numerous and recondite adaptations, showing that God has from the first placed life where it can be wisely and opulently sustained. There is no single plant or animal diffused equally over the whole globe, nor has there been during any previous period of

the earth's history. Thus instructed, we read the narration which implies the universality of the Deluge and ask with some anxiety, whether this implication is necessary? By no means, says the careful Bible reader, for the sacred writers in general, and Moses in particular, frequently employed terms denoting universality to describe local or partial occurrences. Even in the chapter under consideration, the phrase "whole earth" in the ninth verse cannot mean literally the whole, but only that part within reach of the dove's flight; for before that, in verse 5th, we read that the tops of the mountains were seen.

Moses was writing the history of the human race as regards sin and salvation, and not a cosmical survey of all the successive phenomena of the globe.

Gen. vi. 11, 12, 13.—These verses speak of a total destruction decreed of the sinful race, and total devastation of the whole territory occupied by them.

Gen. vi. 19, 20, 21; vii. 2, 3, 4, 8, 9, 14, 15, 16, 21, 23, 24.—In these passages the expressions used are sufficiently comprehensive to include all land animals and vegetables; but there are other places in Scripture where we know that phrases equally forcible are limited by the context, and we accept the conclusions of science that the destruction and devastation were only partial, as not in-

consistent with a sound, simple faith in the whole word of God.

The following passages will serve to show that this interpretation is admissible, for in them it is evidently required.

All the earth, in Judges vi. 37, means the ground round about Gideon's fleece.

In 1 Kings x. 24, means a great many persons, from different countries.

All the face of the earth, in Gen. xli. 56, means Egypt and neighbouring countries.

All the world, in Luke ii. 1, means the Roman empire.

The world, in John xii. 19, means a multitude of the people.

In Acts xix. 27, means the people of Greece and its colonies.

The whole world, in Romans i. 8, means all Christian churches.

All nations and *all the nations of the earth*, in Deut. xxviii. 37; Jeremiah xxix. 18; xliv. 8; xxxiii. 9, mean all persons to whom revelation should come.

Every nation under heaven, in Acts ii. 5, means persons from the contiguous lands there specified.

All the cattle of Egypt, in Exodus ix. 6, means the greater number.—See ver. 19.

The face of the whole earth, in Exodus x. 15, means Egypt.

"To those who have studied the phraseology of Scripture," says Dr. Pye Smith, "there is no rule of interpretation more certain than this, that universal terms are often used to signify only a very large amount in number or quantity." *

Incidental Allusions to Geological Facts.

The sacred writers make frequent references to the physical phenomena of the earth beneath. Are such references in accordance with the facts established by subsequent researches and the observation of travellers, or do the latter convict the former of ignorance and error?

The question is the more important, as the materials of the earth are not treated *conventionally* in the Scriptures, but naturally. In speaking of the sand on the sea-shore, one writer alludes to it as a barrier placed by God against the encroachments of ocean, another as an illustration of the countless host of the Philistines, a third as representative of the multitude of God's people. Far different and more adapted to universal use is this than the employment of one object always to ex-

* Scripture and Geology, 2nd edit. p. 295; see also Hitchcock's Religion and Geology, p. 120.

press one and the same idea, as in the symbolic picture-writing of the Egyptians and Assyrians, and as is the usage in much of the literature of the East. Freedom of language, if not of thought, is unknown where every object is used as a conventional sign, always appropriated to one fixed sentiment.

We shall find incidental accordances between the facts and the record in regard to all things capable of such verification. Take, for instance, the references to stone as an illustration.

The Patriarchs and Israelites are frequently directed to build an altar; the injunction to form it of unhewn stones will be found given where rocks abound; the permission to make it of earth refers to districts in which we now find that stone cannot readily be procured.

The numerous instances given of the setting up of commemorative stones in Palestine, by the Israelites, could not have occurred in the rockless plains of the Euphrates. The geological traveller can readily understand the perfect congruity of the picture which represents the army of the Philistines encamped on one hill, the bands of Israel on the opposite slope, and a brawling brook in the valley between, to which David descended, and from its water-worn pebbles selected five for his sling, smoothened and sharpened by the stream.

The mention of slime for mortar, and brick for

stone, in the Babylonian plains (Gen. xi. 3), in Egypt (Exodus i. 14), and again by the Euphrates during the captivity (Nahum iii. 14), and of bitumen in the vale of Siddim (Gen. xiv. 10), equally corresponds with the present geological character of the regions referred to.

The frequent occurrence of rocks and broken ground in Syria, is the groundwork of much of the scenery reflected in the general language of Scripture writers, and of many incidents in the history. This accurately accords with the actual physical character of the land itself.

The representations of scenery are so minute in some cases—for instance, the rocky defile in Gibeah, 1 Sam. xiv. 4—that it becomes quite easy for travellers to test the fidelity of the writer.

To this kind of criticism the Bible is more exposed than any other book, owing to its variety in time and place, and it need hardly be said that it has escaped not only unscathed, but illustrious, from the trial. The peninsula of Sinai is nowhere formally geographically described in the Bible, but from the record of events alleged to have taken place there, we infer that it was a mountainous district, full of barren rugged rocks, towering into peaks, and cleft by deep dry valleys. Laborde, and the numerous tribe of oriental travellers, in describing the surface scenery, bring before us evi-

dence of the peculiarly appropriate terms in which Scripture alludes to this region. One of the latest travellers thus writes: — "Soon after this we came to an immense plain of hard rocks. The mountains which bounded it were truly magnificent: their numerous summits seemed not so much peaks as spikes, or tall spires of rocks. The whole scene is one of the most magnificent desolation and unmingled terror." *

So, in the limestones, there exist now caverns which are the verifications of the cave of Machpelah, of Adullam, and others, by showing the occurrence of strata in which the requisite phenomena are found; whilst the water-supply of the whole country at present is an accurate reflection of the Scriptural account of wells and streams. The language of David and of the prophet Isaiah could only have been employed by persons familiar with the need of irrigation, and its modes, peculiar to the countries to which they profess to belong. How vividly were the mountains of the Holy Land impressed upon the minds of the principal writers of the Bible! There are about three hundred distinct references in Scripture to mountains; a glance at a good physical map of the region will show the correspondence between the statements of the record and the facts of the earth's surface in the districts referred to.

* H. Bonar, Desert of Sinai.

Were a student shut up in a cell, without any other channel of knowledge than the Word, he might construct a physical geography of the East, which would contain all the leading features of that remarkable portion of the globe. The river of Egypt, with its fertile plains, the stony desert, the rocky Sinai, the hills of Judea, the rivers and lakes, the mountain chains, and the Great Sea, all would fall into their proper places on his ideal map.

So the allusion to "the dust of the earth," will carry a fulness of meaning to persons living in a land where, during a large portion of the year, the whole surface is reduced to dust by the influence of heated winds. God's power in creating man out of such incoherent matter, and man's humble bodily origin and end in this life, are forcibly represented by the frequent employment of this illustration, so familiar to the inhabitant of the East.

In like manner the references to the inundation of the Nile, Amos ix. 5; Job xxviii. 11;—to earthquakes, Isaiah ii. 19; Job ix. 6; xxxiv. 20;—to mines, metals, precious stones, flints, and other mineral substances, are all found to be in accordance with the actual physical phenomena.

The references to *clay* in the Scriptures are frequent, and accord with its uses and localities at the present day. In the ruins of ancient cities we find remains of the stone or brick-built public

edifices, but no trace whatever of the dwellings of the people. These were constructed of mud, either in the manner common in all clay districts, (called "cob" in the west of England), or of imperfectly burnt brick, which equally became speedily resolved into its pristine condition by atmospheric influences, or gave way before the storm. The very site of a homestead raised of earth becomes, in a short time after its abandonment, wholly undistinguishable as vegetation resumes its sway, for mother earth bears no memorial of the lost. This is the image used by the patriarch (Job xiii. 12) and the apostle (2 Cor. v. 1) to set forth the true condition of man as compared with God, or even with angelic beings. The first writer uses the illustration in arguing for the defective moral state of man, so transitory and trivial on earth. "Behold, he put no trust in His servants; and His angels he charged with folly: how much less in them that dwell in houses of clay, whose foundation is in the dust, which are crushed before the moth?" The latter employs it to set forth the glorious contrast between the frail and forgotten habitation of the spirit *here*, and its noble permanent investiture hereafter. "For we know that if our earthly house of this tabernacle were dissolved, we have a building of God, an house not made with hands,

eternal in the heavens." Our physical condition is inferior; we ought not to exalt ourselves against God; what poor creatures are we at our best estate! Taking his stand by the ruins of the clayey tabernacle, he says: Let it be resolved into its native elements and perish for ever out of sight, with all its grievances and defects!

Another class of illustration is derived from the fictile uses of clay. Pottery is the most universal of the arts. It was relatively of more importance when metals were scarce. It was then, also, more homely in its manufacture, and more constantly associated with the habitations of men in small communities. Stand by the potter under his rude shed; he takes a lump of clay from the mass by his side, kneads it, rudely fashions it into shape, places it on the wheel, and in a few moments by a touch moulds it into a vessel of graceful form, or, if dissatisfied, throws it again into the heap, and re-moulds, re-fashions, and converts as if actually creating. This calling has been pursued by all people, in all ages; it was in the daily view of the Jewish people. How expressive, then, become the allusions to clay in illustration of the following truths:

1. God's absolute sovereignty as the master workman. — See Job x. 8, 9; Isaiah xxix. 16; Rom. ix. 21.

2. Man's absolute subjectiveness.—Ps. ii. 9; Isaiah xlv. 9; xxx. 14; Jer. xviii. 6; xix. 11; Rev. ii. 27.

3. Man's appeal to God arising from this relationship.—Ps. lxiv. 8.

Incidental confirmations of the truth of Scripture may be obtained from very many passages of this kind, showing its perfect accordance with well-known facts.

The above are offered as indications of the many directions in which science and religion are connected, and in which the former may be used to deepen the impressions of the latter. We cannot afford to neglect any means of doing this which God has placed within our reach. Sadly loth are we at all times to learn spiritual lessons, though all our true welfare, present and future, depends on the acquisition.

There are endless concealed correspondences between the Bible and existing facts, which ever and anon are brought to light by the unconscious explorer. All objects which minister to this great purpose become dignified by the service; as though a noble inscription, once well-nigh effaced, had been restored to its place, a perpetual memorial of the renown of Him to whom it was at first inscribed.

CHAP. VII.

THE GEOLOGY OF SCRIPTURE LANDS.

It has pleased God to connect religion in its history with the specialities of particular places and people, whilst preparing it for all mankind. Wide as the world in its scope, it is, nevertheless, limited to a small area in its historic associations. Fitted for all time in its provisions, it is yet wedded to a contracted span in its own annals. The advantages of this arrangement are, that we thereby possess an apparatus for first testing and then enforcing its truths; for we can compare the record with the realities which are introduced, and we are all readily susceptible of impressions connected with a local habitation and a name.

The geology of the countries mentioned in Holy Scripture is, as yet, but imperfectly known to us, but quite sufficient has been ascertained to test the accuracy of the incidental allusions made by the writers of the Bible.

The framework of Syria is composed of two mountainous ranges, running in a parallel strike with the coast of the Mediterranean, much broken by transverse clefts, extended by irregular spurs on either side, with detached minor masses, having

the same north and south bearing. Between the two ridges runs the valley of the Jordan, occupying a deep depression, terminating in the Dead Sea.

The body of the country is a mass of Jurassic (oolitic) rocks, overlaid unconformably by a spread of cretaceous deposits (chalk and green sandstones), both much disturbed by outbursts of trappean matter (greenstone and basalt), and scooped into valleys along numerous lines of ancient fracture. The oolite was eroded before the deposition of the chalk, and the latter has been washed and worn away prior to the deposition of the third system, namely the eocene tertiary, which is found in patches, and abounds along the lands of medium height on the shores of the Great Sea. There are a few re-consolidated rocks and gravels of a more recent period, but the bulk of the whole region is a highly contorted, inclined, and broken mass of secondary, metamorphic, and igneous rocks.

The Libanus is an axis of Jurassic rock, with some thin beds of oolite coal, surmounted by chalk, and flanked towards the coast by the great tertiary nummulitic limestone so universal along this parallel of the earth. The chalk contains fossils similar to that of the South of France. The tertiaries are often found isolated after the fashion prevalent in other countries. In some places, conglomerates of the later Jurassic age

occur, containing pebbles and fossils of the lower oolites.

Towards the sources of the Jordan we find igneous rocks prevailing, with their usual concomitants of metallic minerals, highly coloured landscapes, abundant springs, and verdant pastures. Hermon (the highest mountain in Palestine) is formed of limestone with bursts of trap. In this range occur the strata containing abundant remains of fish and vegetable impressions.

Galilee exposes similar conditions; an underlying oolite rock, an overlying cretaceous, with quartz, much broken up by trap.

The upper portion of the Jordan valley, as far south as the lower shores of the sea of Tiberias, are much diversified by greenstone, lavas, pumice, and other kinds of igneous rock.

On the east rise the granitic and trappean mountains of Moab, enclosing a limestone country. In the valley itself are tertiary and post-tertiary accumulations, whilst on the west, the tertiary sandstone occupies in force the plateaus of the subjacent limestone. Mount Tabor is a mass of chalk rock, and the cliffs around the sea of Galilee are much intersected by basalts and lavas.

The Jordan valley itself shows two terraces far above its present waters, both due to its former condition, first as an arm of the Red Sea, and then as a lake.

The Mount of Olives and the other eminences around Jerusalem are composed of chalk with flints; the older limestones appear in the bottom of the deep valleys. This is the substratum of the Holy City and its vicinity. Bethlehem is surrounded by coarse yellow cretaceous limestone.

The Dead Sea is bounded on the west principally by tall cliffs of stratified limestone, with much rubble of an ancient date; towards the south, tertiary, marls, and clays prevail, the whole abounding in traces of volcanic agencies. The upper portion of the long mound at the south of the lake is gypsum, overlying rock-salt, which is furrowed into knolls and pillars. The south-eastern shore is coloured by the bright red of the sandstone; on the east are heavy limestones and chalk, altered by the igneous masses forming the mountains of Moab. The north-east angle is formed of basaltic rocks, with volcanic slag and pumice.

The whole Jordan valley was undoubtedly a vale in tertiary periods; but the Dead Sea appears to have received the remarkable features which now characterise it, subsequently to the deposition of the tertiary beds.*

Extending our survey eastward from Palestine, we may embrace a wide area, extending from Ararat to the head of the Persian Gulf, the ge-

* See Lynch's Official Report of the United States Expedition.

neral features of which are now well known. Many of the groups of secondary sedimentary strata familiar to us in Western Europe also occur here, upheaved together with their overlying tertiary deposits, by igneous rocks, in like manner.

Along the margin of the present river-courses are alluvial deposits now in process of formation. Next, marine alluvium, following the direction of the existing great valleys, opening out into the sea, and still increasing at the outlet. Colonel Rawlinson and Mr. Ainsworth represent the marine alluvium as increasing at the head of the Persian Gulf at the rate of a mile in thirty years.* There are occasional freshwater deposits, showing the former existence of small lakes; somewhat of earlier date are extensive formations of gravel, proving the occurrence here, as in the west, of a period of turbulence at the commencement of the post-tertiary epoch.

The highest tertiary deposits form a system of red sandstone and marls underlying the valleys of the Mesopotamian rivers. This newest red sandstone tertiary is much developed in Asia Minor and thence eastward. It has subordinate beds of gypsum, with occasional naphtha and bitumen springs. Underneath this the nummulitic series extends for 800 miles with a thickness of 3000 feet. This has been much disturbed by elevation, which

* Quarterly Journal, vol. x. p. 465.

has thrown it into domes and waves, constituting much of the peculiar scenery of the Turkish eastern frontier. Below this occurs the cretaceous series in the form of blue marls, white limestone with flints, and hippurite limestone. A few traces of Palæozoic rocks are brought to the surface: the whole is sustained by the granitic axis of the Caucasian chain, and occasionally metamorphosed by ancient volcanic contact.

There are no fossils common to the cretaceous series and the beds above, though both are marine deposits, nor are there any common to the two great tertiary divisions, the nummulitic and the red.

Here then we have, in the region which enclosed the cradle of the human race, the same geological scale as in the west. In the very district where the first tribes of the patriarchs dwelt and extended, there had been, in ages long antecedent, successive oceans and oscillations of the land, constituting a portion of the great series of preparations ere the Genesis of man was appointed. All recorded history is connected with the present condition and configuration of the country, which is demonstrably only the last of many platforms of distinct vital and physical action.

On turning westward towards the head of the Red Sea, we encounter the remarkable peninsula

of SINAI, formed of red sandstone, borne up and rifted by one of the most forcible exhibitions of igneous rocks to be found in the world.

The well-known narrow plain of EGYPT, is a valley bordered by nummulitic rocks of eocene age, interspersed with sandstones. As the plain narrows, the scenery becomes diversified by frowning precipices of granite, basalt, and porphyry, which confine the foaming river at the cataracts, and expand into the mountains of Nubia. The sands, which stretch away towards the peninsula, cover tertiary strata, with silicified forests of the same age.

On approaching the spurs of the Sinaitic range, boulders of red granite and metamorphic rock give indications of the disturbed district beyond.

The connexion between the structure of the country and its history is frequently referred to in that delightful book, by the Dean of Canterbury—"Sinai and Palestine." Thus he speaks of the Sinaitic peninsula:—"The cluster itself consists (speaking in general and popular language) of two formations—sandstone and granite, or porphyry. These two formations, of which it may be said generally that the first constitutes the northern, and the latter the southern division, play an important part, both in its outward aspect and in its history. To these it owes the depth and variety of colour which distinguish it from almost

all other mountain scenery; sandstone and granite alike lend the strong red hue which, when it extends further eastward, is, according to some interpretations, connected with the name of "Edom." It was long ago described by Diodorus Siculus as of a bright scarlet hue, and is represented in legendary pictures as of a brilliant crimson. But viewed even in the soberest light, it gives a richness to the whole mountain landscape which is wholly unknown in the grey and brown suits of our northern hills. Sandstone, however, when, as in the Wâdy Megâra and on the cliffs which line the shores of the Red Sea, it has become liable to the infirmities of age and the depredations of water, presents us with those still more extraordinary hues, of which the full description must be reserved for the scene of their greatest exemplification in the rocks of Petra. In these formations, too, we trace the connection of the Sinaitic range with the two adjacent countries, and with the historical purposes to which their materials have been turned. The limestone ranges of Tîh, in their abutment on the valley of the Nile, furnished the quarries of the Pyramids. It was the soft surface of these sandstone cliffs which, in the Wâdy Mokatteb, offered ready tablets to the writers of the so-called Sinaitic inscriptions and engravings, and to the Egyptian sculptors, in the Wâdy Megâra and the valley of

Sarbût-el-Kedem; just as the continuation of the same formation, far away to the south-west, re-appears in the consecrated quarries of the gorge of Silsilis, whence were hewn the vast materials for the temples of Thebes; as the same cliffs, far away to the east, lent themselves to the excavations of the Edomites and Nabatæans, at Petra, and of ancient Ammon and Moab in the deep defiles of the Arnon, so too, the granite mountains on whose hard blocks were written the ten commandments of the Mosaic Law, and whose wild rents and fantastic forms have furnished the basis of so many monastic or Bedouin legends, re-appear in Egypt, at the first cataract, in the vast grotesque rocks that surround the island of Philæ, and in the vast quarries of Syene; and are to be found far off to the east, in Arabia Felix, forming the vast granite mass of Ohod, the scene of Mahomet's first victory near Medina."*

The frontispiece map shows the character of the subsoil of Syria if the green covering of the present surface were removed. In the lands once occupied by the patriarchs we find, immediately below the soil, traces of still earlier occupants, with which no man was contemporaneous.

Similar maps, constructed from actual observation, indicate that every portion of the earth to which we have obtained access displays the like

* Stanley, Sinai and Palestine, pp. 10, 11.

proofs of a vast series of former surfaces of land and water, existing in continued succession, accompanied by successive developments of creative power, manifested according to a definite plan, and for a definite end.

If the Bible student finds in his own volume no account of these things, it is only that which must be said concerning many other branches of human inquiry.

We have a guide competent for the path of our human pilgrimage, but not commissioned to tell us all that relates to the countries outside.

Doubtless they are unexpected conclusions to which our science leads us. That all the monuments of human history relate only to the last of the hundred changes to which this globe has been subjected, that man upon the earth is comparatively recent, that long ere his advent God was here in the plenitude of power and wisdom, that death has been from the first an appointment connected with earthly life, and that its extension to man was the application, as penalty, of an ordinance previously obeyed by all lower life; these are some of the deductions from which the inscribed stones will not allow us to escape.

We may well be satisfied with that which is written in both records. In attempting to strain after reconciliations, either in physics or metaphysics, where the connection of truth is not

revealed to us, we may wear our faculties and waste our time in useless endeavour after the unknowable. We have to gird ourselves for a different struggle, the encounter with the realities of our being, its duties and delights, its responsibilities and destiny.

But let us not despise the refreshments by the way which an intelligent study of God's works affords. The panorama around us offers a thousand delightful views, and whilst we have to pass on as warriors girt for the battle of life, and as pilgrims who "seek a country," still it is not forbidden to us to gather the scallop-shell and pluck the flower which our benevolent Maker has strewn about our path.

We strengthen our own convictions, and corroborate the testimony of God's Word as to the fact of our high destiny, when we thus speculate on the far-off place of the creation, and the far-off times of its history. Calculated for a longer duration and wider range than anything we see around us, we ought to inquire of the only oracle, "Lord, what wilt thou have me to do?" And this inquiry is the more urgent, seeing that although we have such high connexions, yet we are "of the earth earthy." Without a higher work of obedience wrought for us, and of holiness wrought in us, we shall never rise to the pure enjoyments of a regenerated and ennobled nature.

The grandeur of the provisions of creation d played in the *earth* may prepare us for the lofti grandeur of the provisions for man's recovery a restoration to the Divine favour revealed to us the *word*. The obscurities of both are necessit of the case as it is, and surely need not deter o practical resort either to the one or the other.

"One part, one little part, we dimly scan,
Through the dark medium of life's feverish dream,
Yet dare arraign the whole stupendous plan,
If but that little part incongruous seem.
Nor is that part perhaps what mortals deem:
Oft from apparent ill our blessings rise.
Oh, then, renounce that impious self-esteem,
That aims to trace the secrets of the skies;
For thou art but of dust,—be humble and be wise."

BEATTIE'S *Minstrel*

CHAP. VIII.

BIBLIOGRAPHY.

The History of the Inquiry.

It would be difficult to determine whether the world has been the wiser or not for all the commentaries that have ever been written. The authority of great names has probably given currency to more of error than of truth. Let it be hoped that a more rational method now prevails, and will issue in the future advancement of science. The commentators on Scripture are, however, not chargeable with so much blame in regard to geological science as the philosophers who have made the formation of the earth the subject of disquisition, who have surpassed each other in the flights of imagination, which have been called theories of the earth.

It would be out of place to enumerate here the views of heathen writers, so universally expressed in some form or other on this subject. Nor can we allude at length to the scholastic doctors, or to more than a few of the more modern authors on the same fertile topic; for, ever since the revival of learning in Europe, the press has never been long

without sending forth some new extravagance, doing violence either to Scripture or to science, and most frequently to both. The writings as well of the Greek philosophers as of the Arabians and Hindús contain abundance of cosmogony. Anciently no account of things visible was considered to be complete, without a theory of the world. The principle of *ignotum pro magnifico* has been embodied in the traditions and literature of all nations in regard to the origin of things.

So eminently unpractical a question was exactly the staple required by the scholastic philosophy of the Middle Ages. It afforded positive luxury to the keen disputants of the cloister, who rejoiced in a region belonging neither to heaven nor to earth. Amongst them some, as St. Augustine and St. Anselm, embodied a considerable amount of truth in their conclusions; but in general the result was nothing which could by any possibility be added to the sum of human knowledge—nothing which lessened the pre-existing and surrounding ignorance. The study of fossil remains being the true key to the physical history, it was not to be wondered at that the latter was altogether neglected, whilst the true nature of the former was denied.

The prevalent opinion among the learned for upwards of two centuries after the revival of letters was, that organic remains were mere mineral concretions. Hypotheses were invented purport-

ing to account for their production in methods quite worthy of the school of subtle philosophy whence they issued.

This was maintained, not by obscure monks, but by really accomplished persons, the lights of natural history in their day, such as Fallopio, Mercati, and Olivi in Italy, Plot and Lister in England, Agricola in Germany.

The last-named person was a pious physician, at Chemnitz, who devoted himself to mineralogy, and was much in advance of his age. In his work, published in 1549, he maintains the mineral character of the marks of organic fossils, and, with equal gravity, the existence of demons peculiar to the mines: the latter he classes in two divisions, the Bergenteufels and Bergeneulen. His opinion as to the nature of fossils was combated occasionally by the more practical minds of the age, amongst others by Palissy, the potter, in 1580; but it subsisted till 1752, when Mr. Bertrand, a Swiss clergyman, made a last effort in its favour, contending that they were the unfinished forms of real creatures, and the connecting link between organised and unorganised matter. It has again been raised from well-merited oblivion by Mr. Gosse.* Such is error, so subtle as long to elude the force of the plainest demonstration; so obstinate, as to cling from one post to another

* See Omphalos, 1857.

ere it can be finally driven away. Especially is it dangerous when a supposed theological necessity is invoked for its support, for it then becomes injurious to a more precious interest, and obstructive to the reception of true religion.

The Italian geologists, as we learn from Sir Charles Lyell,* were the most enlightened naturalists of their age.

The excavations made for repairing the city of Verona, in 1517, brought to light a number of fossil remains, the appearance of which exercised the wits of that time; and, amongst others, *Frascatoro* boldly expounded their true meaning and relations. He declared that they had not originated in any such "plastic force" as was pretended, nor could they have been the results of the waters of the deluge.

After having been thus rescued from the mineral kingdom, they were, however, universally attributed to the deluge. *Fabio Colonna*, in 1600, and the whole of the Italian writers of this period, considered that all petrifactions were the remains of the Noachian deluge. This was the orthodox opinion.

In 1669, *Steno*, a Dane, attached to the Court of Tuscany, expounded the true theory of organic fossils; he laboured to harmonise his views with Scripture, by selecting strata, which appeared to

* Principles, chap. i., whence these notices of Italian opinions are derived.

him to be unfossiliferous, and treating them as having been created before the existence of animals and plants. Steno suggested that Moses, when speaking of the loftiest mountains having been covered by the deluge, meant merely the loftiest of the hills then existing, which may not have been very high. The diluvial waters he supposed may have issued from the interior of the earth, into which they had retired when in the beginning the land was separated from the sea.

In 1676, *Quirini* contended that the diluvial waters could not have effected all the operations attributed to them, and maintained that the universality of the Mosaic deluge was not to be insisted on.

In 1688, *Robert Hook*, the learned mathematician, in his posthumous treatise on earthquakes, assigns to organic remains their true character, and supposes that some species may have been lost, which was consistent, in his opinion, with the doctrine of Scripture that the world is degenerating. In his diluvial theory he attempts to crowd into the time between the creation and the deluge, and into the latter, all the visible phenomena of upheaval or dislocation.

A far different work was published in 1670, De Gotte's, "The Divine History of the Genesis of the World," a book which we have not seen

quoted in the history of the inquiry. It adopts an independent method of investigation, and is distinguished by a free spirit of inquiry combined with supreme reverence for the Word of God, and great felicity in statement and illustration. The scope of his work may be judged of by the following extract from the introduction: "Wherefore, now, O Christian world! who art a collection not only of men but of Christians, judge thou, according to both capacities, whether Scripture be not the truest Comment that ever was made upon nature; and that thou mayest rightly discern between, set the short system of divine Genesis by all or any other whatsoever. And, now, after so many Christian ages, let it be once determined whether this be a true history of the creation or not; and if it be (as most undoubtedly it is), let us no longer be bereaved of so great a treasure, which has hitherto, I know not how, been not only hid underground but trampled on by the feet of men."

Nor were the opinions of the pious and accomplished *Ray*, the father of modern and scientific natural history, more rational than those of his compeers. Much did he write and labour in the construction of an elaborate theory; but though he received with the reverence of a little child the dictates of Scripture concerning the mightier matters of his salvation and obedience, yet, in

matters not immediately connected with these, he must needs philosophise to accommodate the imperfect knowledge of that day with the apparent requirements of theology.

In 1690, Dr. *Thomas Burnet*, Master of the Charter House, published his "Sacred Theory of the Earth," an eloquent, marvellous work, still readable and frequently to be found on our bookstalls. His grand aim was to construct a complete theory for past, present, and future. He describes the earth at the beginning as a fluid mass composed of all kinds of materials. The heaviest descended to the bottom and formed a solid kernel, around which the waters, and afterwards the atmosphere, united, but between the water and atmosphere there was formed an oily stratum, which received, little by little, all the earthy constituents with which the air was still charged. On this consolidated bed, marshy, thin, uniform, level, without mountains, without valleys, without either seas or rivers, lived the antediluvian generations. At this epoch the marshy crust, dried up by the heat of the sun, split and fell down in the great abyss of waters. From thence came the universal deluge, the disarrangement of the axis of the globe, and the changing of climates. The earth thus drowned had still some cavities into which the waters entered little by little, and so returned to their

subterranean reservoir. Thus the ocean is a part of the great abyss, the isles are the fragments, the continents are the great residuary masses of the old world. To the confusion brought about by the breaking up of the waters are owing the mountains and other undulations that we now see. This is a specimen of a large class of writings, which passed for the effusions of learning and piety in the Augustan age of English literature.

In 1696, *Whiston*, the great astronomer, published *his* new theory of the earth. Accustomed to look at the heavens astronomically, the learned and rash philosopher called in the aid of a comet: he conceived of the earth as still having in its midst a solid and burning kernel, retaining the heat which it received from the sun when it was only the nucleus of the comet, and continually spreading it towards its circumference. This nucleus is itself surrounded by a great abyss, which is composed of two rings, of which the lower is a heavy fluid and the upper water; it is this layer of water which constitutes the foundation of our earth. The deluge was occasioned by another comet striking the earth, and was the parent of all the disturbances now manifest in its crust. Whiston interpreted the first verse of Genesis i. as narrating the creation of an uninhabited comet, in the atmosphere of which the materials formed

a chaos, enveloped in thick darkness. From the first day, when the atmosphere of the comet was disembarrassed of all its solid and earthy parts, it ceased to resist the rays of the sun, and thus, all at once, was produced light. The inhabitants of the world became corrupt, and the mist from the tail of a comet produced the judgment of the deluge.

About 1680, the great *Leibnitz* wrote of the earth as an extinct sun vitrified. According to him, its greater portion was the subject of a violent fire, at the time when Moses tells us that the light was separated from the darkness. The fusion of the globe produced a vitrified crust; when the crust was cold, the humid parts, which had risen in vapour, fell again and formed the ocean. The seas then deposited calcareous rocks. It at first enveloped all the surface of the globe, and surmounted the higher parts which at present form the continents and isles. Thus the shells and other rubbish of marine animals that one finds everywhere, prove that the sea has covered all the land; and the great quantity of fixed salts, of sand and other matters, fused and calcined in the earth, testify to the universal fire, and that it preceded the existence of sea.

In 1695, *Dr. Woodward* (the founder of the professorship at Cambridge, which has given so

distinguished a light to geology as the present holder of the chair, Professor Sedgwick), in his "Discourse on the Natural History of the Earth," most ably vindicates the proper nature of organic remains, and disposes of the views of those who attribute them to casual inundations, or to the wash of the sea when the land was first made; but he is equally unsuccessful in the formation of an hypothesis as his predecessors.

He holds that at the deluge the solid strata of the earth were dissolved in the water; the remains of animals sank down and became imbedded according to their relative gravity. And yet our philosopher was not only an able man, but a good observer and collector.

In Italy a more correct form of philosophising was springing up.

Vallisneri, finding by his own careful observations that the facts were not in accordance with the theories then in vogue, which were affirmed to be founded in the interpretation of Scripture, attacked the interpreters, and demonstrated that they were in error. He wisely contented himself with recording his own observations, and would not attempt the construction of a theory.

In 1740, *Moro*, on the other hand, with much that is valuable in his onslaught upon other cosmogonists, fell into the error of becoming one of their number. His theory, however, is much more

consistent as well as reverential to the truth, than that of any of his predecessors.

In 1749, *Buffon* published, like his fellow-philosophers, a theory of the earth, which is now found in the first part of his collected works. It is a free and easy way of world-making with the aid of a sun, a comet, volcanic and aqueous forces at pleasure. The Sorbonne required him to recant so much of his work as expressed the sentiment that the waters of the sea had produced the land, and then left it dry, and that the land was again, by wear and tear, gradually merging into the sea. The recantation is published with his works. These gorgeous dreams cost their author forty years' thought, and enjoyed uncommon reputation. Even now, their decision of tone and eloquence of statement command an interest.

This is the last of the formal splendid fictions which so long occupied the thoughts of philosophers and usurped the name of geology.

In 1756, *Lehmann*, the German mineralogist, confined the action of the flood to the production of a few only of the rocks, assigned the unfossiliferous strata to the original creation, and the conglomerates to an intermediate revolution.

In 1760, *Michell*, who held for eight years the Woodwardian professorship at Cambridge, showed himself as the true predecessor of modern geology. Neglecting cosmogony altogether, and applying

himself to the description of the strata as they appeared under his own observation, he discovered the true sequence of the beds, and indicated a direction in which the geologist might pursue his labours without infringing on theology.

After Michell the visions of the cosmogonists were again reproduced by various English writers. Sound geology, however, began to take precedence of world-making; the actual wonders of the subterranean world were preferred to the gay creations of the world-makers. Hutton, William Smith, and a host of followers, comprising Cuvier and Brogniart, kept the republic of letters well employed in acquiring the grammar of the new science, which was being created by physical researches into the strata and their contents. Henceforward cosmogony assumes a second-rate position.

De Luc, in 1799, wrote of the chronology of Moses as only commencing with the creation of man; and of the days of creation as being not natural days but indefinite periods. A long line of illustrious men, many of whom are now living, diverted attention from the vain attempts of the early philosophers, and occupied themselves exclusively with descriptive geology. Some of them, however (and more not *of* them), have essayed to break a lance in the old tourney. A classification of opinions — taking only the views of the leading men — will serve to show, in a general

way, what has been said and done for the last fifty years in this department of knowledge.

The following are the principal hypotheses:—

1. That the days of creation are indefinite periods, during which all the phenomena of geology occurred. That the deluge is now marked by the drift and gravel remains of the post-tertiary age. Cuvier, Parkinson, Jameson, and others.*

2. That the first sentence of Genesis has no connection with the subsequent verses. The phenomena of geology have place between the first and second verse. The chaos was universal and ushered in the present creation.—*Chalmers*, 1804. See also "*The Earth's Antiquity in harmony with the Mosaic Account of Creation, by James Gray, M.A.*" 1849.†

3. That the earth that now is was the bed of the ante-diluvian sea. That all the phenomena, now visible, resulted from operations in the interval between the creation and the end of the deluge. That, save this, the rocks were created as they now exist.—*Granville Penn, Young.*

4. That we cannot rely on an interpretation of the Hebrew records, and therefore we may set

* The last exposition of this theory is in the "Course of Creation" of Dr. Anderson; Longman, 1850. A work full of eloquent description and admirable reasoning.

† The present writer did not see this excellent work until after the foregoing chapters were in the press.

them aside when apparently at variance with geological facts.—*Babbage.*

5. That the records are poetical representations and not historical.—*Baden Powell.*

6. That the first verse is a detached account of the original creation. The chaos, the six days' creation, and the flood, were local phenomena, and refer to what was transacted in the province occupied by man only.—*Dr. Pye Smith.*

7. That the "days" were great natural periods. The Palæozoic system, pre-eminently that of plants, is the work of the third day; the secondary, pre-eminently the epoch of sea-monsters and creeping things, is the work of the fifth day; and the tertiary, the time of mammalian creatures, is the work of the sixth day.—*Hugh Miller.*

8. That the Mosaic narrative is a revelation made in visions to the mind of the prophet, the days are therefore spoken of not in connection with the events, but the duration of the vision. The events occurred in extremely lengthened periods. The deluge was partial. — 1854. *Mosaic Record in harmony with Geological.* 1854. *Genesis of the Earth and Man.*

9. That all creation took place consecutively, according to the literal reading of Genesis i. All things, fossil and recent, form part of one whole system of life, and were created at once on the successive days of creation. That the fossil spe-

cies have become gradually extinct, and their remains buried by disturbances occurring from the first.—*L'Abbé Sorignet,* 1854.

10. *P. H. Gosse,* 1857. The theory of this interesting writer is a reproduction of Granville Penn, with a dash of the old arbitrary anti-geologic notion of the creation of the rocks, with fossils complete as they are. He affirms a principle which he calls the law of "Prochronism," in virtue of which the strata of the surface of the earth, with their fossil floras and faunas, may possibly belong to a "pro-chronic" (*i. e.* to an unreal and symbolical or typical) development of the mighty plan of the life history of the world. Mr. Gosse has thus added another name of note to the illustrious list of system-mongers, who have been seduced from the simple path of observation into the labyrinth of world-making, by an assumed theological necessity, which has no existence. The construction by good men of such violent hypotheses implies an urgent conviction on their parts of the magnitude of the difficulty to be overcome. Had they applied their minds to the humbler task of learning the facts of the science, with which they deal so summarily, the difficulties would have diminished or quite vanished, and their learned labours would have taken a more useful direction. Such attempts are clumsy votive offerings disfiguring the shrine they are intended to adorn.

The preceding account, though it is only a very general view of the principal hypotheses on this subject, yet sufficiently shows how the minds of the framers have felt the power of the Sacred Writings. They have done homage, all unconsciously in many instances, to Divine truth, by acknowledging the necessity of accordance with it, however widely they have diverged from its plain teaching. It is a notable instance of the commanding power of the Scriptures, that thus, through ages of ignorance and periods of enlightenment, they should still have been the pole-star, guiding all voyagers in their pathless track towards the unknown.

The temper of the disputants on both sides has always been commendable; in this, however, as in other intellectual battles, the usages of war are more charitable now than in days of yore.

The sound advice of Dr. Wiseman is acted on to some extent. He says: —

"So long, indeed, as phenomena are simply recorded, and only the natural and obvious causes drawn from them, there can be no fear that the results of the study may prove hostile to religion. How much wiser was the counsel of Gamaliel, and how applicable to those who impugned these pursuits. . . . Refrain from these men and let them alone; for if the work be of men, it will fall to nothing; but if of God ye are not able to destroy

it. . . . If the representations they have given of nature are the fictions of men, they cannot stand against the progress of science; if they truly picture the work of God, they must be easily reconcilable with his revealed manifestations."*

11. We have reserved until last, as being on the whole the most comprehensive and satisfactory, the conclusions of Mr. Crofton, which have now for some years been before the world, and have not been refuted by any philologer. He affirms that, apart from geological considerations, and judging from analogy with Scripture alone, the interpretation of the Sacred Volume renders the following ten propositions credible.

1. That the absolute age of our earth is not defined in the Sacred Volume.

2. That there may have been a long interval in duration between the creation of "the heaven and the earth" mentioned in the first verse of the first chapter of Genesis, and the continuation of the earth's history in the second verse.

3. That the term "the earth" does not apply necessarily, in every instance, to the whole of our planet, but sometimes only to a part of it.

4. That the state of the earth, described in the second verse as "without form and void," does not necessarily mean matter never reduced to form and order, but may signify matter reduced to dis-

* Lectures, p. 188.

order, after previous organisation and arrangement.

5. That the "darkness" "upon the face of the deep," also mentioned in the second verse, is not negative of the previous existence of light, but may have been only a temporary one.

6. That the commencement of the account of the first six days' creation, dates from the beginning of the third verse, "And God said, Let there be light."

7. That the act of "the first day" does not necessarily signify the creation of light, but may have been only the calling it into operation upon the scene of "darkness," described in the second verse.

8. That the calling "the light Day" and "the darkness Night," with the declaration, that "the evening and the morning were the first day," does not necessarily imply that this was the first day, *absolutely* speaking.

9. That the work of "the second day" mentioned in the sixth, seventh, and eighth verses, may have been only an operation performed upon the atmosphere of our earth.

10. That the work of "the fourth day," described from the fourteenth to the eighteenth verses, does not necessarily imply that the sun, moon, and stars, were then first created or formed, for the first time, from pre-existent matter; but

may only have been that they were then, for the first time, in the detail of the history of the present earth, made visible to it, and ordained to their offices with respect to the coming human creation.*

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* Genesis and Geology, by Denis Crofton, B.A.

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